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Human Resources Research Organization
300 North Washington Street
Alexandria, Virginia 22314

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(9) Consulting Report

(6) REVIEW OF THE CONARC SYSTEMS ENGINEERING OF TRAINING PROGRAM AND ITS IMPLEMENTATION AT THE UNITED STATES ARMY AVIATION SCHOOL

(10) Darwin S. Ricketson, Russel E. Schulz
Robert H. Wright

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HumRRO Division No. 6 (Aviation)

HUMAN RESOURCES RESEARCH ORGANIZATION

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FOREWORD

This report presents a review of the CONARC program for systems engineering of training and its implementation at the U. S. Army Aviation School (USAAVNS). It was carried out as a Technical Advisory Service at the request of the Education and Training Research and Development Division, DCSIT, CONARC. This review provides information descriptive of the systems engineering program at USAAVNS, a detailed analysis of CONARC Regulation 350-100-1, *Systems Engineering of Training - Course Design*, and conclusions and recommendations for consideration in efforts to improve the effectiveness of systems engineering of training.

The data collection for this study was conducted during the latter half of Calendar 1969. Therefore, the conclusions drawn cannot be construed as necessarily representing the status of the USAAVNS systems engineering program subsequent to that time. In fact, USAAVNS has initiated a number of positive changes in the program after that period. It should be noted by the reader of this report that certain of the material presented (Appendix C) is based upon expressions of opinion by individuals participating in the systems engineering program at USAAVNS. Their statements, while representing their views, may not in some instances have been representative of the true state of affairs at the time of the study. Also, their statements cannot be construed as representing official USAAVNS position. They do, however, present an insight into the systems engineering program as perceived by working level personnel in the program.

Military support for the study was provided by the U. S. Army Aviation Human Research Unit, Fort Rucker, Alabama. LTC Ralph V. Gonzales was the Unit Chief at the time the study was initiated. LTC Durnell V. Schull is the present Unit Chief.

HumRRO research is conducted under Army Contract DAHC 19-70-C-0012, and under Army Project 2J062107A712, Training, Motivation, and Leadership Research.

Wallace W. Prophet

WALLACE W. PROPHET
Director
HumRRO Division No. 6 (Aviation)

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SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. MILITARY PROBLEM

With the February 1968 issuance of USCONARC Regulation 350-100-1, *Systems Engineering of Training - Course Design*, a major program was initiated for improving the effectiveness of Army training and reducing its cost through systems engineering. This program represents a pioneering effort to utilize modern training technology in the design of training courses throughout a large-scale system.

The procedures for systems engineering of training require much more detailed analysis of job tasks, training objectives, training techniques and evaluation methods than customary in most past training program development efforts. Therefore, some problems in fully effective implementation of such a large-scale effort should be, and were, anticipated.

However, USCONARC has encountered some difficulty in obtaining systematic feedback regarding the exact nature and extent of the problems being encountered in implementation of the systems engineering program, and the assistance that would be most effective in minimizing these problems. As a result, HumRRO Division No. 6 (Aviation) was requested to explore implementation of USCONARC Regulation 350-100-1 at the U.S. Army Aviation School (USAAVNS), and provide information which may be of help in advancing the quality of systems engineering efforts throughout USCONARC.

B. METHOD

A flexible investigative approach was adopted to cover representatively USAAVNS systems engineering personnel, to provide insight into the mechanics of implementing USCONARC Regulation 350-100-1, and to elicit possible solutions to the significant problems being encountered.

Two interviews were conducted with USAAVNS systems engineering program administrative personnel to obtain information concerning program organizations, administrative procedures, and difficulties encountered during the first year of operation.

Based on the results of these interviews, curriculum development groups from each of the four participating instructional departments were interviewed concerning program organization, orientation and guidance requirements, usefulness of reference materials, and mechanics of implementing USCONARC Regulation 350-100-1. From information collected to this point, a questionnaire was constructed to survey that background of curriculum development group personnel considered most relevant to the systems engineering program.

Initial review of USCONARC Regulation 350-100-1 and interview comments regarding its implementation led to the conclusion that a systematic analysis of the regulation was required before t' complex problems of implementation could be understood and potential solutions recommended. Such an analysis was completed and involved the determination of: (a) the procedural steps required; (b) the necessary systems engineering products and subproducts; (c) the required flow of information between products and subproducts; (d) the necessary guidance and personnel expertise required to complete the products and subproducts, and (e) those revisions to the organization of the regulation that would alleviate the most significant problems encountered.

C. CONCLUSIONS

The following conclusions are listed in order of priority by topic within each heading:

1. USCONARC Regulation 350-100-1

It was concluded that USCONARC Regulation 350-100-1:

a. Does not clearly identify the step-by-step procedures and "chain link" interrelationships which are essential to the systems engineering process.

b. Provides more guidance than normally found in a regulation, but less than in a "how-to-do-it" manual, and fails to cite adequate reference materials where gaps exist in procedural guidance.

c. Fails to require documentation of the "ideal" training program before compromises are made due to limitations in presently available resources. Thus, no basis exists for long-term program changes oriented toward the "ideal" training program, or justification of requirements for new training resources.

d. Inadequately provides for the review, validation and approval of systems engineering products. For example, the USAAVNS reviewers of such final products do not appear highly familiar with the systems engineering program or individual curriculum development group efforts.

e. Considers only tangible objects in the objects axis of the matrix form task inventory. This exclusion, by implication, of intangible factors significantly limits the types of Army jobs to which the task inventory is applicable.

f. Fails to consider further, once tasks have been selected for school training, those tasks not selected and does not insure that they will be accounted for through course prerequisite, on the job training, extension courses, or other means.

g. Orients the process of training quality control toward the use of test results, rather than field performance data, and does not provide systematic procedures for feeding corrective actions back into the training program.

h. Does not provide clear procedural guidance for, or sufficient references to, existing materials on test construction. Further, the logic employed in deriving testing standards is not apparent and the validation process suggested can demonstrate only face validity of the test.

2. Systems Engineering Program Personnel

It was concluded that:

a. The systems engineering program Education Advisor's workload is such that sufficient day-to-day guidance for each curriculum development group is precluded.

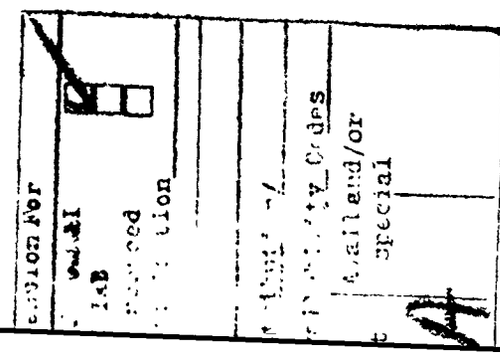
b. Standards have not been developed to specify adequately minimum qualifications for curriculum development group personnel. The resulting inability of curriculum development groups to fully assess state-of-the-art training techniques and equipment makes it likely that systems engineered courses will be oriented toward presently available training techniques and equipment to the exclusion of long-term program changes oriented toward "ideal" training programs.

c. New curriculum development group personnel do not receive a satisfactory orientation to the mechanics of working level implementation of USCONARC Regulation 350-100-1, and often require two months training on the job before they adequately function in the program.

d. High rates of personnel turnover within some curriculum development groups have resulted in a general reduction of USAAVNS systems engineering program productivity.

e. Minimal use has been made of systems engineering and training technology references mainly because such materials have not been stressed or made readily available to curriculum development group personnel.

f. USCONARC needs to support more fully the systems engineering program through close expert guidance for, and regular meetings with, program administrators and Education Advisors.



3. The USAAVNS Systems Engineering Program:

It was concluded that:

a. Most problems existing in the systems engineering program are due to insufficient guidance and personnel resources, and not related to the concept of systems engineering of training.

b. Without improved guidance and personnel resources, only marginal benefits to training programs are anticipated, and it is doubtful that such improvements will justify the cost and effort.

c. At present, the USAAVNS systems engineering program appears to be functioning at a higher degree of proficiency than should be expected, considering the handicaps being encountered.

D. RECOMMENDATIONS

The following recommendations are listed in order of priority by topic within each heading.

1. USCONARC Regulation 350-100-1

It is recommended that USCONARC Regulation 350-100-1:

a. Be systems engineered to reflect an organization that clearly identifies the systems engineering elements of work (products/subproducts) and the required flow of information (inputs/outputs) between them.

b. Fully state procedures indicating how the systems engineering work is to be accomplished, as well as what work is to be accomplished where such information does not exist in the literature (otherwise, such literature should be cited).

c. Should require documentation of the "ideal" training program before compromises are made due to time and resource limitations.

d. Should make provisions, where necessary, for systematically reviewing, validating, and approving systems engineering program products/subproducts by personnel fully aware of the nature and purpose of the program.

e. Should, in defining tasks for job and training analysis, remove the restriction to tangible objects so that tasks involving intangible factors will not be excluded.

f. Should further analyze tasks, among those not selected for school training for which uncertainty exists regarding the correctness of their disposition, to verify that no requirements exist for them to be school trained.

g. Should orient training quality control more toward the use of field performance data, and provide systematic procedures for feeding corrective actions back into the training program.

h. Should reorient the procedural guidance for test construction toward distinguishing between minimally acceptable and unacceptable job entry level students.

2. Systems Engineering Program Personnel

It is recommended that:

a. Education Advisors qualified in systems engineering of training be added to the SEP in numbers sufficient to provide CDGs with the technical systems engineering guidance required on a day-to-day basis.

b. Policies for assignment of personnel to CDGs should be established, assuring sufficient levels of both field and instructional experience within each CDG.

c. Personnel turnover problems should be decreased by requiring long-term assignments for senior level personnel, which will maintain continuity within each CDG.

d. Systems engineering and training technology references should be made readily available to each CDG by establishing a library of these materials in the CDGs' location at each participating school.

e. USCONARC support of the SEP should be improved by providing close expert systems engineering guidance to SEP administrators and Education Advisors, and by scheduling regular meetings with them to discuss SEP progress.

f. Since CDG knowledge and experience in the mechanics of training technology is highly limited, CDGs should have access to the specialized training expertise required to accomplish the SEP milestone at hand.

CONTENTS

Chapter I

BACKGROUND

A. Military Problem

For years Army training programs have been recognized as models of "best available" training programs from both instructional and management standpoints. There has been recognition, however, that fuller utilization of modern training technology should yield substantial improvements in effectiveness and efficiency of Army training.

In recent efforts to improve system-wide Army training, primary emphasis has been on aligning training programs with entry-level job performance requirements. USCONARC Regulation 350-100-1 (the Regulation), issued 1 February 1968, established requirements for systems engineering of training programs and represents the latest effort in this trend to improve Army training. The Regulation provides for systems engineering of training programs in a manner consistent with the state-of-the-art in training program design and management which, when successfully implemented, will meet job requirements with a maximum possible level of training efficiency.

Since the Regulation requires design of training programs in a manner substantially different from past Army training program development, some difficulties in its implementation can reasonably be anticipated. To date, implementation of the Regulation represents significant improvements over past training program development. However, it appears that difficulty is experienced in actually attaining the quality and efficiency in systems engineering of training desired by USCONARC, its service schools, and training centers.

This report is the result of an effort initiated in response to a letter (Appendix A) from the Education and Training Research and Development Division of USCONARC, to the Director of HumRRO Division No. 6 (Aviation). The letter indicated that informal information and research requests brought an awareness of difficulties experienced in implementation of the Regulation at some USCONARC schools. The dearth of expertise needed for effective and timely implementation of the Regulation led USCONARC to consider ways in which the schools could be assisted in carrying out their responsibilities as specified in the Regulation. Prospective areas indicated for consideration were: (a) assembly of a library of publications pertaining to systems engineering to be forwarded to all USCONARC schools; (b) establishment of an additional course on systems engineering management procedures; and (c) R&D efforts to develop a "how-to-do-it" manual on systems engineering of training. HumRRO Division No. 6 (Aviation) was requested to explore these ideas with representatives of the U.S. Army Aviation School (USAAVNS) at Fort Rucker and provide any recommendations, comments, or other information which could be used to advance systems engineering efforts throughout USCONARC.

B. Approach

Although HumRRO Division No. 6 has not made a formal programmed effort to assist USAAVNS in implementing the Regulation, the systems engineering program is of considerable interest and has been followed closely through informal coordination and minor consultation with both administrative and working level personnel. However, this coordination and consultation did not provide exposure to detailed working procedures and specific problems or the in-depth familiarity with the Regulation necessary for full appreciation of day-to-day working level problems and potential solutions to them.

The initial coordination did, however, result in the tentative conclusion that a primary difficulty in implementing the Regulation at USAAVNS was a lack of sufficiently detailed procedural guidance to permit the activities of curriculum development group (CDG) personnel to be efficiently and effectively structured. Neither satisfactory documentary procedural guidance, nor sufficient qualified supervisory personnel were available to provide guidance of work procedures to assure production of fully satisfactory products in each step of the Systems Engineering Program (SEP).

Consequently, efforts of HumRRO Division No. 6 personnel were oriented toward determining those portions of the Regulation requiring more detailed definition and the nature of changes needed, and also toward determining that supervisory support and guidance which might further alleviate difficulties in USAAVNS' implementation of the Regulation. Inherent in this approach is the assumption that a practical solution for improving the effectiveness of the SEP is likely to involve a combination of documentary and administrative improvements.

The investigative approach employed in this study was informal and flexible, was adopted to provide representative coverage of SEP personnel with minimum demands on their time, and was intended to elicit suggestions concerning significant SEP problems and viewpoints regarding their potential solution.

Chapter II

METHOD

The study was initiated with review of the Regulation and informal interviews with USAAVNS SEP administrative personnel. Subsequently, in-depth interviews were conducted with members of four CDGs, a background questionnaire was administered to CDG members, and the Regulation was analyzed in detail.

A. Administrative Interviews

Two interviews with administrative personnel were conducted to obtain information concerning SEP organization, administrative procedures, and difficulties encountered during the first year of operation. Attending the first interview were the Director of Instruction (DOI), Deputy DOI, Curriculum Division Chief, SEP Project Officer, and the DOI SEP Education Advisor. HumRRO Division No. 6 was represented by its Director, a Research Scientist, and the Chief, U.S. Army Aviation Human Research Unit. Topics discussed included coordination of the SEP between USCONARC schools, implementation of the Regulation, and qualifications and assignment stability of CDG personnel.

Second interview attendees were the SEP Project Officer, the DOI SEP Education Advisor, a DOI SEP Education Specialist, and three HumRRO researchers. Topics discussed included more detailed coverage of subject matter in the first interview, guidance of CDGs, DOI/USCONARC coordination, orientation of CDG personnel, and departmental/SEP interactions.

B. CDG Interviews

Based on information obtained from administrative interviews and initial review of the Regulation, a topical outline of questions for CDG interviews was developed (Appendix B). The major areas chosen were composition of CDGs, organization of the SEP, orientation and training requirements for CDG personnel, management and technical guidance requirements, availability and usefulness of reference materials, and implementation of the Regulation. This outline of questions was a means of insuring comprehensive coverage of topics in each CDG interview and was not intended to limit discussion.

From the four USAAVNS departments participating in the SEP, experienced systems engineering personnel were interviewed by the three HumRRO Division No. 6 researchers. Of the 42 CDG personnel, 24 (57%) were interviewed, with the remaining 18 being absent or recently assigned and, thus, inexperienced.

Attending the four group interviews were eight of nine from the Fixed Wing CDG, seven of eight from Rotary Wing, five of thirteen from Maintenance Training, and four of twelve from Air Traffic Control. No time limits were

imposed, and each interview was concluded (typically in three to four hours) only after all desired comments were made.

Each HumRRO researcher recorded information during the interviews. Information from all interviews was then pooled and consolidated into consensus statements within each topic area covered (Appendix C).

C. CDG Background Questionnaire

Based on information collected thus far, a questionnaire was constructed (Appendix D) to survey the background of CDG personnel considered most relevant to the SEP. Questionnaires were distributed to 34 of the 42 CDG personnel, of which 27 were completed and returned. The information obtained was then analyzed according to rank and number of personnel in each CDG, length of assignment, and experience relevant to the SEP within and between USAAVNS departments.

D. Analysis of the Regulation

Initial review of the Regulation and interview comments regarding its implementation led to the conclusion that systematic analysis of the Regulation was required before the complex problems of its implementation could be fully understood and potential solutions recommended.

The analyses documented in Appendices E, F, G, and H were based on the Regulation exactly as written, and do not incorporate any of the changes recommended in this report.

The first step taken in analyzing the Regulation was to determine what procedural steps the Regulation required for systems engineering of training courses. Since systems engineering is a product-oriented concept, the process, exactly as described in the Regulation, was broken down into major products and their subproducts. Products were defined as the major units of work required to systems engineer a training program. Subproducts were defined as elements of work resulting in documented information which is required to complete a product. Both products and subproducts may yield information necessary to complete any other product or subproduct in the SEP. After the products/subproducts were identified, they were arranged on a block flow diagram (Appendix E) as they occurred in the Regulation. This diagram highlights the sequential nature of the systems engineering process, by identifying each product and subproduct in the order it is to be completed. Further, it enables one to gain an overview of the process which is not provided by the present edition of the Regulation.

The flow of information, or input-output links, between products and subproducts, was determined to be a factor critical to the successful implementation of the Regulation. These input-output links are not fully evident from study of the Regulation, yet full awareness of all output

links of a product or subproduct was found to be essential to the ability to produce it in a satisfactory manner. Therefore, these links were divided into inputs required by each product/subproduct from other products/subproducts and outputs of each product/subproduct required by other products/subproducts, were determined and listed in outline form (Appendix F). To obtain a global view of this information-flow analysis, and to make it more conveniently usable, the links between all products/subproducts of Appendix F were organized into matrix form (Appendix G). This outline was found to be quite useful in detailed analysis of each product/subproduct required in the Regulation, due to the awareness it provided of the "downstream" uses that would be made of each product/subproduct.

Information about the Regulation collected to this point indicated a lack of adequate provisions for sufficient guidance and personnel expertise. Therefore, each product/subproduct shown in Appendix E was evaluated according to eight content factors including: (a) clear identification of products/subproducts; (b) sufficiently detailed procedural guidance; (c) provision of adequate definitions of terms; (d) identification of input-output requirements; (e) satisfactory use of examples; (f) citing of reference materials; (g) identification of personnel experience needed; and (h) identification of skills and knowledges needed. This information was then organized into tabular form and is presented in Appendix H. This table represents the primary summary of the analysis of the Regulation, and provided the authors a guide in writing most of the items in the Results section (Chapter III) related to analysis of the Regulation.

Based on information from the interviews, questionnaire, and Regulation analysis, it was determined that a major difficulty in the SEP could be alleviated through reorganization of the Regulation's content. An outline of a portion of the Regulation showing such a reorganization is presented in Appendix I, and includes consideration of: (a) the clear identification of products/subproducts; (b) the input-output interdependency between products/subproducts; (c) the specific and practical definition of terms used; (d) any special personnel experience or skills and knowledges required; (e) the detailed procedural guidance required to complete each product/subproduct; (f) sufficient examples with a wide range of applicability; and (g) citation of generally and specifically relevant reference materials for each product/subproduct. This format was employed as a standard while reviewing and analyzing the Regulation, and, in part, formed the basis for many of the ideas regarding the Regulation expressed in the Results (Chapter III), Conclusions (Chapter IV), and Recommendations (Chapter V) of this report.

Chapter III

RESULTS

Full understanding and benefit from the results presented below are unlikely without study of the associated appendices. Appendices E, F, G, H, and I are crucial to an understanding of the rationale behind much of the discussion concerning analysis of the Regulation. Review of the content of these appendices before proceeding with the Results section is highly recommended.

The results are presented under the following major sections: CDG Personnel; SEP Management and Guidance; and The Regulation. Findings descriptive of working level CDG personnel are in the CDG Personnel section. The SEP Management and Guidance section concerns USAAVNS' SEP management and systems engineering guidance provided working level CDG personnel. Information from analysis of the Regulation and its implementation is presented in The Regulation section. Only selected parts of the Regulation are discussed because, as written, the Regulation is not intended to provide particularized step-by-step systems engineering procedures. This section intends only to discuss those portions that were either obviously difficult for CDGs or that illustrate concepts in need of further consideration. The selected parts of the Regulation are treated as they appear in the Regulation, with this order not necessarily representing the systems engineering sequence as performed by USAAVNS CDGs. All references to page number or paragraphs found in The Regulation section refer to those in the Regulation (e.g., Reg. p. 8 and Reg. p. 9, par. 4b).

The USAAVNS SEP has been in effect since September, 1968, and those data concerning it were collected prior to November, 1969. Thus, the results should be considered representative of the time frame from September, 1968 through October, 1969, and are not necessarily reflective of the USAAVNS SEP since then. Additionally, results in The Regulation section are concerned only with the 1 February 1968 edition of the Regulation and should not be construed as necessarily applicable to any forthcoming revision of the Regulation.

The results are written as composite statements of information provided by administrative and CDG interviews, CDG background questionnaires, and analysis of the Regulation, and are identified (I = Interviews, B = Background Questionnaires, and R = Regulation Analysis) according to the source(s) of information.

A. CDG Personnel

1. Of the 42 CDG personnel systems engineering 13 USAAVNS courses (Appendix J), 27 personnel responded to the background questionnaire (20 officers, 4 enlisted men, and 3 civilians). Of the 27 respondents, all officers were rated aviators and all enlisted men and civilians had extensive military maintenance experience (no enlisted ATC men responded). (B)

2. Time in military service for the 27 CDG respondents ranged from 34 to 300 months with a mean of 113 months. (B)

3. Of the 27 CDG respondents, 19 had experience as military instructors ranging from 4 to 168 months with a mean of 25 months; 22 had some college training, and 6 had college degrees; 25 had served one or more tours of duty in Vietnam, and 22 had tours in Europe, Korea, or other overseas areas. (B)

4. The ideal background of a CDG should include extensive experience in the element of Army aviation they are systems engineering and working knowledge of course development, curriculum planning, programs of instruction, lesson plans, test design and development, and training aids, equipment, and facilities. (I, R)

5. The orientation of new CDG members to the Regulation and the SEP requires considerable improvement. (I, R)

a. The majority of CDG personnel attending the USCONARC TV tape orientation covering major points of the Regulation indicated that it was of limited value due to the broad brush treatment of the extensive amount of material covered. (B, I)

b. The only courses at USAAVNS related to systems engineering are methods of instruction (MOI) and a systems engineering workshop (SEW). Six of the 27 CDG questionnaire respondents reported completing both MOI and SEW, 14 MOI only, and 4 SEW only. In the interviews, most CDG personnel reported that these courses were only marginally useful to working level systems engineering. Both courses were short and emphasized management or supervisory approaches. (B, I)

c. A formal course in systems engineering, tailored specifically to the Regulation, should be required for all personnel assigned to a SEP CDG. (I, R)

d. The systems engineering administrator holds a briefing explaining the specific steps for completing a phase of work preparatory to the start of work on each phase of systems engineering. However, CDGs need daily guidance throughout the phase to keep work on the right track. (I)

B. SEP Management and Guidance

1. The number of personnel within each CDG is sufficient to accomplish the systems engineering job. However, the rate of personnel turnover (Appendix K) seriously handicaps some CDGs' systems engineering effort. (I)

a. Personnel turnover results in an almost complete loss of systems engineering experience. Little continuity of expertise exists in CDGs due

to turnover, and inadequate provisions for recording decisions and rationale employed in day-to-day work, e.g., lack of secretarial help, projectors, tape recorders, and other equipment. Difficulties in understanding the rationale employed in work previously completed have led new CDG members to reconstruct or greatly modify systems engineering steps previously completed. (I)

b. Turnover results in a reduction of CDG productivity in that new members require one to two months OJT before they are able to make an adequate contribution to the systems engineering effort. (I)

2. Staffing of CDGs is the responsibility of USAAVNS training departments. (I)

a. USAAVNS training departments are not authorized personnel slots for CDGs, and the release of personnel to CDGs strains each department's capability. (I)

b. The net effect of personnel reductions within training departments is to lower the expertise level of CDGs because difficulties in meeting primary training responsibilities make the training departments less inclined to release their senior and more experienced personnel to CDGs (Appendix K). (I)

3. Primary day-to-day guidance in implementing the Regulation is provided all CDGs by a single Education Advisor. (I)

a. Even though the SEP Education Advisor is well qualified, his administrative workload is such as to preclude sufficient day-to-day guidance for each CDG. (I)

4. Provisions for review, validation, or approval of CDG systems engineering products are inadequate as made by either the Regulation or USAAVNS (Appendix L). (I, R)

a. The intent of product reviews is not clearly defined, with some CDG members questioning whether reviews are for format or content of products. (I)

b. Review of completed products frequently is delayed due to the heavy SEP administrative workload. Since information from any given product is required for optimal completion of a following product(s), delays due to slow review of products may contribute to false starts, i.e., work initiated on a new product that must be reconstructed as the result of a previous product being disapproved. (I)

c. There are no adequate provisions for interim review of products in process. Since some products require months to complete, interim reviews by SEP administrators would help maintain more standardized and acceptable products. (I)

5. USCONARC guidance provided the SEP needs to be improved. (I, R)

a. The Regulation provides "how-to-do-it" guidance not normally found in such a document. However, the information provided is deficient in that it fails to allow the straightforward step-by-step systems engineering of course design. The present edition of the Regulation is more than a regulation, but less than a "how-to-do-it" manual. (I, R)

b. There appear to be no USCONARC personnel, available to USAAVNS, with sufficient systems engineering expertise to provide close supplemental guidance in implementation of the Regulation. (I)

c. Supplementary guidance and coordination of systems engineering efforts between USCONARC and the participating training centers should be the result of meetings scheduled for discussion of mutual problems. (I)

6. CDGs report making minimal use of reference materials listed in the Regulation's bibliography. (I)

a. Systems engineering and training technology reference materials have not been made readily available to CDGs (copies of HumRRO documents in the Regulation's bibliography have subsequently been made available to the USAAVNS SEP). Technical reference materials such as training manuals (TM) and field manuals (FM) dealing specifically with the courses being systems engineered are available to CDGs and are widely used. (I)

b. Some CDG members reported difficulties in relating the systems engineering and training technology materials to each other and to the Regulation because of the non-standardized terminology employed. (I)

c. The importance of reference materials listed in the Regulation's bibliography to the systems engineering process has not been sufficiently emphasized. The utility of a reference document to facilitate completion of a given product is rarely explained in the Regulation. The Regulation does indicate, however, that CON Pamphlet 350-14 may be useful in developing training objectives, but few CDG members interviewed were even aware of the Pamphlet's existence. The one CDG member interviewed who had studied the Pamphlet indicated that it was useful as a supplement, but was difficult to follow because it employed a set of terminology different than that in the Regulation. (I, R)

C. The Regulation

1. The need to clarify and amplify the Regulation was summarized by one CDG member who stated that: "The CONARC Reg does not prescribe how systems engineering is done. We've gone through the motions, but we really don't know what we're doing." (I)

2. Job Analysis (Reg. pp. 8-20). The introductory statements on Reg. p. 8 are not clear. (R)

a. Although two procedures for completing the job analysis (one for existing jobs and one for new jobs) are identified in Reg. p. 8, par. 2, the rationale for either of these procedures is not explained. (R)

b. As written, Reg. p. 8, par. 1 leads the user to believe that job analysis is the major source of guidance and information upon which all subsequent steps in the systems engineering process are based. It should be pointed out, however, that more detailed guidance from systems engineering and training technology documents is needed in order to complete optimally each systems engineering step. (R)

3. Job Analysis: Identification of the Job (Reg. pp. 8-12). With the exception of the following points, the job identification section is well defined and outlined. (R)

a. This section is identified in Reg. p. 8, par. 3 as descriptive of the minimum information needed for job identification, but no suggestion is provided as to the nature of the optimal information for job identification, nor the consequences of describing the job with a minimum of information. (R)

b. An example of a job optimally identified should be presented, detailing each essential element. (R)

c. USAAVNS G-1 furnishes CDGs with identifications of jobs to be systems engineered. (An example is presented in Appendix M). (I)

d. The information sources in Reg. p. 10, par. 5 are intended to, and do, provide ample reference materials for completing the job identification. However, the Regulation does not provide such a list of references for other sections, nor does it indicate where the references in Reg. p. 10, par. 5 may be useful in completing other items of work (see A 10. Outputs, Appendix G). (R)

4. Job Analysis: Task Inventory (Reg. pp. 12-20). All CDGs report considerable difficulty in developing the task inventory. (I)

a. The intended organization of the matrix form task inventory by tangible objects, as indicated by the order of steps in preparing it (Reg. pp. 16-17, par. 16), does not appear to be a systematic or satisfactory method of organization. Many important flight tasks cannot be categorized in this fashion, and the Regulation provides no further organizational guidelines or categories. In contrast, organization of the outline form task inventory is more clearly and systematically indicated by a breakdown into major duty areas. (I, R)

b. Field data concerning USAAVNS jobs are not yet available from the Office of Personnel Operations Military Occupational Information Data Bank (OPO MOIDB), so task inventories are based primarily on related TMs, and FMs, and CDG members' knowledge of the jobs. Regardless, CDGs report that OPO MOIDB task listings are not satisfactory for preparation of task inventories because important tasks are frequently omitted, while others are described in excessive detail. (I)

c. Most CDG members agree that the Regulation's definition of a task (Reg. p. 12, par. 6, and pp. 12-13, par. 8) is global and open to a wide range of interpretations both within and between CDGs. Additional and specific guidance is needed regarding the level of detail to which tasks are defined. The Regulation's definition of a task has led some CDGs toward a tendency to define tasks in excessive detail, with no distinction between the level of detail for tasks of primary and collateral duties. The detailed definition of tasks has often confused CDGs in the attempt to distinguish between properly identified tasks and their supporting skills and knowledges. (I, R)

d. Only tangible objects are considered in the objects axis of the matrix form task inventory (Reg. pp. 16-17, par. 16a). Exclusion by implication of intangible subjects of action verbs significantly limits CDGs' abilities to provide adequate inventories of Army aviation tasks. Many training objectives--such as the application of ATC rules, regulations, and procedures, geographic orientation, flight paths, airways, holding patterns, and maneuvers of various types--are difficult to describe when the object axis of the task inventory is restricted to tangible objects. (I, R)

e. USAAVNS developed a list of action verbs intended to cover the majority of task inventory action verbs for Army aviation tasks. New action verbs suggested by CDGs may be approved and added to this list when accompanied by unambiguous standard definitions. A USCONARD-published list of approved action verbs, their definitions, and synonyms would be an important tool for CDGs and would allow results of the Army's SEP to be entered into a master task data bank system. CDGs would be allowed to add to this list in the absence of suitable action verbs, and easily followed procedures for incorporating such additions should be developed and distributed to each CDG. (I, R)

f. Although of major concern in development of satisfactory task statements, qualifiers to action/object relationships receive scant treatment. Several types of qualifier lists (e.g., list of ATC regulations, list of flight rules and procedures, etc.) may be required in the task inventory, but the example given in Reg. Figure 3, p. 19, shows only an equipment list, leading the user to expect requirements for only this type of qualifier. (I, R)

g. It is suggested in Reg. p. 20, par. 16d4, that subtasks or duplicate tasks purged from the task inventory matrix should be recorded

for later use when deriving training objectives. However, no further reference to use of such a list was found in the Regulation. This is an excellent example of why the Regulation itself needs to be systems engineered. All systems engineering products and subproducts should be carefully reviewed with their relationships to other products and subproducts clearly defined and identified (see Appendices F, G, and H).

h. The potential need for several draft versions of the task inventory, and review of these versions by technically qualified personnel, is indicated in Reg. p. 15, par. 11. This review and approval of draft versions is an important part of the SEP, but receives only cursory emphasis throughout the Regulation. It would be of considerable value if the Regulation would fully define "technically qualified" personnel and provide specific procedural guidelines for review of systems engineering products at appropriate points in product development. (R)

5. Selecting Tasks for Training (Reg. pp. 21-23). This section lacks sufficient emphasis on the criticality of proper selection of tasks for school training to SEP success. (I, R)

a. Guidance provided for the process of selecting tasks for school training appears not to consider the task in its entirety and may result in premature elimination of tasks which should be considered. For example, at this point in the SEP, tasks have not yet been divided into their subtasks, and the selection decision is made without full knowledge of the training requirements for each element of the task. (R)

b. The need for review, validation, or approval of the selection of tasks for training should be made explicit since such requirements are at least mentioned for other steps in the Regulation (see Reg. p. 15, par. 11). (R)

c. Once a task has been selected or rejected for school training, the Regulation makes no provisions for documentation of the decision rationale employed. Subsequently, the reasons for selection or rejection of a task would be lost to the CDG, reviewers of the task list, and new CDG members. At USAAVNS, CDGs coded each task on the inventory with one or more of the twelve selection/rejection criteria shown in Appendix N. (I, R)

d. The Regulation specifies (Reg. p. 23, par. 4) that tasks selected for school training be identified as such on the original task inventory. However, no instructions specify procedures for dealing with tasks in the not-selected category. It would be highly desirable to indicate specifically on the original task inventory the disposition of all not-selected tasks. (R)

e. Those tasks not selected for school training receive no further consideration in the Regulation. In the beginning, the process

of selecting tasks for school training should err on the side of retaining tasks rather than excluding them. Those tasks not originally selected for school training should continue to be carefully analyzed, insuring that they are accounted for through prerequisite requirements, OJT, extension courses, or other means. Provisions should be made for close coordination with agencies to whom the responsibility for training not-selected tasks has been relegated. Failure to satisfactorily account for a task through means other than school training should qualify it for re-entry on the list of tasks being considered for school training. Such a selection process would reveal tasks or subtasks that, for example, should be trained by OJT, but cannot be so trained for administrative or other practical reasons. Such tasks, especially in new jobs, performed by only a small percentage of job incumbents and for which no satisfactory job aids, manuals, or experienced supervisory personnel are available, may not readily permit accomplishment of OJT. Additionally, provisions for those tasks considered as prerequisite (e.g., skills taught in a prerequisite course) for entry level students should be considered. A listing of such tasks and their required skills and knowledges could be employed in screening entry level students for identification of deficiencies and remedial training requirements. (R)

f. The first sentence of Reg. p. 23, par. 5 contains the instruction not to consider existing limitations in time, funds, facilities, equipment, and personnel in selecting tasks for school training. At this stage of the systems engineering process such a tabula rasa point of view in selecting tasks for school training is essential to success of the SEP. However, the last sentence of Reg. p. 23, par. 5 instructs training agencies to make all possible internal adjustments before requesting additional resources, and this appears to conflict with the spirit of the tabula rasa instruction. These conflicting statements may have been responsible for CDG members reporting that their task selections were influenced by a variety of resource limitations which also appeared to enter into the decisions of higher level personnel reviewing/approving the lists of tasks selected for school training.

Reg. p. 23, par. 5 should be written to reflect a utopian approach in the selection of tasks for school training. At this initial stage of the systems engineering process, such an approach should result in an "ideal" training program that is documented as such before tradeoffs are made due to limitations in presently available resources. Without a documented "ideal" training program, no basis exists for long-term program changes oriented toward "ideal" training or justification of new resource requirements for an improved training program. Any considerations or decisions regarding internal adjustments and additional required resources should specifically be referred to in later stages of the systems engineering process, e.g., Reg. p. 49, par. 4. (I, R)

6. Identifying Job Conditions, Standards, and Supporting Skills, Knowledges, and Attitudes (Job Task Data Cards (JTDC) (Reg. pp. 24-30)). CDGs reported difficulty in preparing JTDCs and that, once completed, little use was made of them. (I)

a. Some CDG members reported that the purpose of JTDCs was not clearly defined in the Regulation, and, as a consequence, little use was made of them once they had been completed. (I)

b. In developing JTDCs, some CDG members reported the first instance in which the "chain-link" process of systems engineering broke down. They discovered that tasks selected for school training did not readily lend themselves to preparation of JTDCs. A major problem encountered was that tasks had been defined in such excessive detail that tasks listed in JTDCs had no subtasks. With this lack of success in preparing JTDCs, most CDGs found it necessary to make major revisions to steps preceding JTDC preparation. (I)

c. Many job standards for aviation tasks are published, but USAAVNS CDGs failed to identify them on JTDCs beyond simply listing the TM number. Since information from job standards is required in later products, the Regulation should specifically define the level of detail to which job standards should be recorded and explain how and where this information will be employed later in the SEP. (I, R)

7. Converting Job Requirements to Training Objectives (Reg. pp. 30-34; 45-49). There was considerable confusion among CDGs in their interpretations of the guidance provided in the Regulation for preparation of training analysis information sheets (TAIS). Three major areas of confusion were reported: (a) Identification of JTDC task elements requiring preparation of TAISs; (b) uncertainty as to when the lesson analysis portion of the TAIS should be completed; and (c) general confusion concerning procedural guidance provided for completion of specific steps within the TAIS. (I)

a. CDGs were confused concerning which JTDC task elements required TAISs. The first sentence of Reg. pp. 30-31, par. 9, states: "The tasks and subtasks recommended for training, their associated conditions and standards, the supporting skills and knowledges, the significant attitudes will be converted to training objectives (performance objectives)." However, while a given task may require school training, some of the associated subtasks, skills and knowledges, attitudes, etc., may not require school training, and therefore, it would not be necessary to convert them into training objectives. Confusion in this area has resulted in considerable variation in TAISs prepared between CDGs. Further, the Regulation should make provisions for applying the same criteria to JTDC subtasks, skills and knowledges, conditions and standards, and significant attitudes as were applied in selecting tasks for school training. In this manner, those job elements requiring school training may be identified as requiring preparation of

TAISs. Those not requiring school training may be already in the student's response repertoire or relegated to OJT training, extension courses, or other accountings. (I, R)

b. Completion of the learning analysis portion of the TAIS (Reg. pp. 45-49) was reported as being particularly difficult. Specific difficulties with the subparts of the lesson analysis operation are discussed later in this report. However, a major problem was that of determining when the lesson analysis should be performed. Obviously, the training objective must first be identified before lesson analysis is initiated. However, the proper sequence for completing the lesson analysis (Reg. p. 45), development of criteria (Reg. p. 34), determination of course sequencing (Reg. p. 35), and preparation of evaluation planning information sheets (EPIS) (Reg. p. 43), is not clearly stated. More specifically, is lesson analysis conducted before or after these steps? (I, R)

c. As discussed previously in this report (Chapter II, B6c), the Regulation (Reg. p. 31, par. 9) references CON Pamphlet 350-14 as a document that provides additional guidance for preparation of training objectives, but CDGs report not making use of it. (I, R)

d. Most CDG members agree that the Regulation does not provide sufficiently detailed guidance for deriving training standards and criteria. CDG members did not clearly differentiate standards and criteria. Further, they were confused as to whether training standards and criteria should be based on acceptable performance immediately after completion of training of the objective, or on acceptable performance for course graduation. (I)

e. The development of training objective criteria (Reg. p. 34, par. 16) is a cursory and confusing treatment of criterion development, with no definitive distinction between training objective criteria and testing standards. One may assume that training objective criteria are identical to testing standards, or that they are training-related criteria not necessarily identical to testing standards. The conclusion that training objective criteria and testing standards are identical derives from a statement in the testing section (Reg. p. 52, par. 2) which specifies that the purpose of testing is to "evaluate student accomplishment of the training objectives as specified in the criteria."

The conclusion that testing standards are not necessarily identical to training objective criteria is based on the Regulation's procedural guidance for actually deriving testing standards from training objectives, rather than from training objective criteria. Under this latter conclusion, the purpose of training objective criteria would be to indicate the sample of student behaviors that an instructor should elicit in order to satisfy the training objectives, and testing standards would not then necessarily have to be the same as training objective criteria. If there is a distinction between the two terms and their application, it should be clearly stated; otherwise, a single term should be used if no difference exists.

Further, guidance provided for criterion development should include a suggested preview of Appendix E of the Regulation. One CDG, having nearly completed systems engineering its course, found that the criteria it had developed for TAIS completion required considerable modification for use as the basis of test standards development. (I, R)

8. Course Structure (Reg. pp. 35-42). CDGs report that the Regulation implies that sequencing of training objectives to form the course structure is simple and straightforward, when in fact this process is very difficult. However, no suggestions were offered as to how the Regulation could be modified to facilitate this process. (I)

9. Course Evaluation (Reg. pp. 43-44). Procedures for preparing evaluation planning information sheets (EPIS) are not clear. (I, R)

a. The reason for selecting this point in the Regulation's text to initiate consideration of student evaluation is neither stated nor apparent. Such an evaluation precludes consideration of teaching points, methods of instruction, and training media, aids, equipment, and facilities found in the learning analysis (Reg. II, pp. 45-49). (R)

b. The suggestion (Reg. p. 45, par. 23) to list all training objectives within each cluster conflicts directly with the first sentence on the following page which instructs that each EPIS will not contain all training objectives within each cluster. Thus, there is considerable confusion as to whether there should be a sampling of training objectives within each cluster for evaluation purposes. If it is intended that some training objectives be excluded from EPIS clusters, the purpose of EPISs as they relate to performance sampling and testing should be clearly defined and guidance provided for determinining the basis of including or excluding any given training objective. (R)

c. It seems reasonable to consider training criteria in preparing EPISs. Some criteria more readily lend themselves to one type of evaluation (e.g., written) than to others (e.g., oral or practical exercise). Preliminary identification of evaluation methods might lead to the development of EPISs that are more compatible with test outline requirements. (R)

10. Learning Analysis (Reg. pp. 45-49). CDGs report considerable difficulty in preparing the TAIS learning analysis. (I)

a. The appropriateness of placing the TAIS learning analysis (Reg. pp. 45-49) after course structure (Reg. pp. 35-42) and course evaluation (Reg. pp. 43-44) is questionable. Since development of course structure and course evaluation require consideration of the learning analysis, it seems desirable to develop the TAIS learning analysis immediately after development of TAIS training objectives and criteria (this was the order USAAVNS CDGs adopted). (I, R)

b. Some CDG members reported that their groups lacked sufficient experience/skills and knowledges to prepare adequately the TAIS lesson analysis. However, most CDGs interviewed had not reached this SEP phase and the information obtained concerning it often was fragmentary and difficult to understand. (I)

c. Development of that part of the TAIS learning analysis dealing with teaching points is difficult. Some CDG members report that they were instructed to include skills and knowledges, conditions, and attitudes as teaching points rather than as training objectives. Also, some teaching points are covered by teaching points of other training objectives, and the Regulation does not adequately define procedures for determining and dealing with similar or duplicate teaching points. (I, R)

d. It is likely that most CDG members lean heavily on presently available training equipment when determining training equipment requirements, because of their lack of knowledge concerning state-of-the-art training equipment, and because there is no Regulation provision for documentation of an "ideal" training program (see Chapter III C, par. 5g). Some CDG members suggested that the Regulation should provide listings for interim and "ideal" long-range training equipment requirements. Interim equipment would be that not ideally suitable for training, but whose use is presently considered necessary for reasons of cost, development time, and other practical factors. (I, R)

e. Development of time estimates for teaching learning elements is particularly confusing to CDGs; e.g., is the time estimate to be based on one student or an entire class? Should time estimates include allowances for setting up before and cleaning up after a P.E., or closing out sessions within a large teaching block, or review at the end of instruction periods? Further, CDG members express the fear that their estimated times will have a tendency to become actual times through their submission in Programs of Instruction (POI). CDGs desire a USAAVNS "shakedown" test of the POI prior to its submission to USCONARC. (I)

11. Developing Instructional Materials (Reg. pp. 49-51). No comments were made on this section of the Regulation during the CDG interviews because only one CDG had reached this point. At USAAVNS, responsibility for this section was relegated to the instructional departments. (I)

12. Testing (Reg. pp. 52-69). The testing section is presented in a simplistic, generalized, and logically incomplete manner. Testing is not simple and, as presented in the Regulation, requires tests and measurements knowledge/experience to understand. Within the Army literature, there are several documents related to test construction, to which the Regulation should refer the user at each appropriate step. (R)

a. The testing section tells what is to be done, but makes inadequate provisions for describing how it is done. For example, in the instructions for arranging and grouping training objectives for testing purposes (Reg. p. 55, par. 11a), the Regulation explains that this step "is necessary for instructional purposes because many of the tasks are so complex that they can only be learned in parts before the whole task can be mastered." This information is appropriate and accurate, but does not instruct the user in a procedure for utilizing it or refer him to explanatory documents in the considerable literature on part-versus-whole-task training. The Regulation should be written with the user's skill/experience level in mind. (R)

b. Often, guidance provided in the Regulation is not explicit and can result in confusion. For example, the Regulation states (Reg. p. 55, par. 11b) that: "The possible versions of the training objectives selected for testing purposes must be identified and listed in the test outline." Since there is considerable difference between a sampling of training objectives and a sampling of versions of a training objective, the penalities of confusing the two can have far-reaching effects on the design of a training course. (R)

c. In the Regulation, (p. 58, par. 11c(1)), it is stated that: "The total number of versions or repetitions tested for any one class must be sufficient to indicate whether or not the students have mastered the objective." The implications of this statement (e.g., its relationship to criteria) are not explained in the Regulation, nor are procedures presented for implementing the steps required. With the guidance provided, it is unlikely that the average USAAVNS CDG could complete this step as intended. (R)

d. In developing test standards (Reg. pp. 60-64) the Regulation provides an example on page 60, paragraph 14a describing the logic process involved in transforming the training objective standard for a dictation task into a test standard. However, the item is worded specifically for dictation tasks, and such analysis concepts, oriented toward a specific task, might be difficult to apply to aviation tasks. If key analysis concepts were taken from this item and written as a checklist of testing concepts to consider, the example could more easily be understood and would probably produce more standardized test standards. (R)

e. The Regulation informs the reader (Reg. p. 63, par. 16b) that: "It is difficult to establish precise testing standards for tasks that have qualitative job standards, such as oral briefings and staff studies." However, the Regulation does not inform the reader how to deal with imprecise job standards, nor what the consequences of such standards are. The same criticism may be made of page 64, paragraph 16e, in the statement that: "Any test standards set should take measurement error into account." The Regulation says what to do, but not how to do it. At very least, it should refer the user to documents in the literature that fully explain the points being made. (R)

f. The process suggested for validating the test (Reg. p. 68, par. 20a) is insufficient treatment of the work required. First, the concept of test validation is complex and the Regulation devotes only seven lines to defining it and providing procedural guidance for its completion. Second, the validity described is face or common-sense validity and thus, is hardly validity at all. At this point in the SEP face validity may be the most practical way of evaluating a test, but the Regulation should not imply that this method can demonstrate a test to be valid. The test of validity should be oriented toward discriminating between minimally acceptable entry level students and those who are not acceptable. (R)

13. Training Quality Control (Reg. pp. 70-78). The training quality control section contains the same major deficiency as the section on testing, i.e., the subject area is so complex that it is difficult to explain fully and present adequate procedural guidelines for completion. Again, however, the Regulation neither makes this point, nor does it provide references for supplementary guidance. Further, this section is oriented almost exclusively to the use of test results, not field performance data, and inadequately makes procedural provisions for feeding back corrective actions into the training program. Since no CDG had reached this phase of the SEP, all comments below are based on analysis of the Regulation. (R)

a. The Regulation states (Reg. p. 70, par. 1) that: "Training quality control must be viewed as a continual, empirically-based process consisting of analyzing various feedback information and adjusting the instructional systems." The use of feedback from internal (test results) and external (field data) sources is indeed essential to the success of any course of instruction. However, the Regulation inadequately provides procedures for systematically obtaining, recording, or analyzing feedback from the field. Further, the user has no idea of how much negative feedback from which source(s) of information may warrant changes in the training program. Since specific procedures for use of field feedback in training quality control are not well documented in the Regulation or elsewhere, the Regulation should treat this topic in particular detail. (R)

b. The Regulation emphasizes the use of test results at the expense of de-emphasizing the use of field performance data. However, even the Regulation's use of test results needs clarification. Regulation pages 74-76, paragraph 7, presents the interpretation of test results in terms of test instrument deficiencies and student performance. However, this item only identifies problem areas by concept, e.g., the test may not be a valid measure (Reg. p. 75, par. 7a2), and does not describe how one determines what testing variable is responsible for poor test performance. Even if a particular test item is pinpointed with a high percent miss, any number of variables could have contributed to the deficiency, and the Regulation describes no method for reviewing

the systems engineering course design materials, the actual training class situation, or the testing situation, in order to identify the deficiency source. (R)

c. One contingency not discussed in the interpretation of test results (Reg. pp. 74-76, par. 7), is when students show no obvious deficiencies in test results, but fail to perform adequately on the job. Such an occurrence could indicate that the test inadequately reflects training objective requirements, but the Regulation does not describe how one investigates this possibility. It could indicate that the test is a valid measure of the training objective requirements, but that the training objectives do not reflect on-the-job performance requirements. Regardless, the Regulation inadequately treats the subject of test validity (see Chapter III C, 12e of this report). (R)

d. Once a deficiency in student achievement is identified as resulting from a flaw in the training program, the Regulation provides no procedures for correcting it other than to simply state in Regulation page 77, paragraph 9a, that the training environment will, ". . . require adjustment on a continual basis, of all elements of the instructional system." Further, the Regulation makes no provisions for systematically analyzing the implications an adjustment will have on other portions of the training program. (R)

Chapter IV

CONCLUSIONS

The following conclusions are based on interviews with USAAVNS SEP administrative and CDG personnel, CDG background questionnaires, analysis of the Regulation, and desirable practices in curriculum development and training management.

A. The USAAVNS SEP

1. There is a consensus of opinion that the SEP can yield significant improvements over previous approaches to training development. However, without improved documentary and advisory guidance and personnel resources, only marginal benefits to training programs are anticipated, and it is doubtful that such improvements will justify the effort and cost.

2. The problems reported in implementing the Regulation are not considered related to the concept of systems engineering of training, but to inadequate guidance and resources provided for implementation of the concept.

3. The present USAAVNS SEP appears to be functioning at a substantially higher degree of proficiency than expected, considering the handicaps being encountered.

B. USAAVNS SEP Personnel

1. Standards have not been developed that adequately specify minimum qualifications for CDG personnel. The level of field experience within CDGs is generally sufficient, but varies due to personnel turnover. However, CDG knowledge and experience in the mechanics of training program development, especially training technology, are highly limited. With this inability of CDGs to fully assess state-of-the-art training techniques and equipment, it is likely that systems engineered courses will be oriented toward existing training methods and equipment, and unlikely that the courses will have provisions for long-term program changes oriented toward "ideal" training.

2. New CDG members do not receive a satisfactory orientation to systems engineering concepts, or to the mechanics of working level implementation of the Regulation. As a result, new members require one to two months OJT before they are capable of adequately functioning in the SEP.

3. High rates of personnel turnover within some CDGs have resulted in confused work efforts, loss of SEP expertise, the reconstruction of previously completed work, and a general reduction of USAAVNS SEP productivity.

4. The SEP Education Advisor's administrative workload is such that sufficient day-to-day guidance for each CDG is precluded.

5. USCONARC support of the SEP can be improved by a document providing detailed "how-to-do-it" procedures, close expert systems engineering guidance for, and regular meetings with, SEP administrators and Education Advisors to discuss SEP problems.

6. Minimal use has been made of systems engineering and training technology reference materials mainly because such materials have not been made readily available to CDGs, and their use has not been stressed by the Regulation or USAAVNS.

C. The Regulation

1. The present edition of the Regulation provided more guidance than normally found in a regulation, but less than provided in a "how-to-do-it" manual. In general, the Regulation tells what to do, but not how to do it. Further, the Regulation fails to provide reference materials for the user where gaps exist in procedural guidance. Compounding this situation, CDG personnel lack skills and experience in the mechanics of training program development and state-of-the-art training technology.

2. The particular types of tasks the Regulation considers tends to limit its applicability among Army jobs. For example, only tangible objects are considered in the objects axis of the matrix form task inventory. Exclusion by implication of intangible subjects of action verbs significantly limits the number of Army jobs to which the task inventory is applicable (intangibles abound as key elements in the Army aviator's job). Further, the Regulation fails to provide procedures for establishing standardized SEP terms, action verbs, and objects. All SEP terminology should be standardized on a USCONARC-wide basis with CDGs being allowed to add to this list in the absence of suitable terms.

3. Procedures for review, validation, and approval of systems engineering products are inadequate as provided by either the Regulation or USAAVNS. The Regulation provides no such systematic review process and the USAAVNS' system is handicapped with a "bottleneck" due to the SEP administrator's heavy workload. Additionally, reviewers of final SEP products do not appear highly familiar with the SEP or individual CDG efforts, and there seems to be no systematic recourse for CDGs when they feel a reviewer may not have fully understood the rationale employed in completing a product/subproduct.

4. Once tasks are selected for school training, those tasks not selected receive no further consideration in the Regulation. Tasks in the not-selected category are not further analyzed to insure that they are accounted for through prerequisite requirements for entry level students, OJT, extension courses, or other means. The Regulation fails

to consider those tasks not satisfactorily accounted for, and makes no provisions for circumstances that would qualify them for re-entry on the list of tasks being considered for school training.

5. A major tenet on which systems engineering of training program design is based, proposes that at some time during the process, such an approach should result in definition of an "ideal" training program. However, the Regulation does not require documentation of such an "ideal" training program before changes are made due to limitations in presently available resources. Without documentation, no basis exists for long-term program changes oriented toward an "ideal" program, or justification of requirements for new training resources.

6. The procedures presented for completing the testing phase of the SEP are too simplistically described, and are logically incomplete in several places. As in other parts of the Regulation, this section informs the user what is to be done, but inadequately describes how it is to be done; and, this deficiency in procedural guidance is not accompanied by sufficient references to documents in the Army literature related to test construction. Further, the logic employed in deriving testing standards is not apparent, e.g., the differences between, or interrelationships among, training objective standards and criteria on the TAIS, and testing standards in the testing section are not evident. Additionally, the validation process suggested can demonstrate only face validity of the test and is not, as it should be, oriented toward discriminating between minimally acceptable and unacceptable entry level students.

7. The section on training quality control has the same major deficiency as the section on testing (i.e., it tells the user what to do but not how to go about doing it), and it does not provide references for supplementary guidance. Further, the Regulation's process of training quality control is oriented toward the use of test results rather than field performance data, and does not provide systematic procedures for feeding corrective actions back into the training program.

8. The job of systems engineering (the Regulation itself) needs to be systems engineered, so that the step-by-step "chain link" process required to complete each product/subproduct is more apparent to the user. If the Regulation was revised to reflect such a process, many difficulties experienced by CDGs in implementing the Regulation would be eliminated. In the current Regulation, many specific elements of work (products/subproducts) are not clearly identified by paragraph headings, with some being buried within paragraphs and their necessity only implied. Conversely, the content of many paragraph headings appears unrelated to the required products/subproducts. Further, the Regulation fails to identify the interdependencies between products/subproducts. Since systems engineering is an information flow oriented concept, the flow of information (required inputs and outputs) between products/subproducts should be clearly and specifically defined.

Chapter V

RECOMMENDATIONS

The following recommendations are listed in order of priority by topic within each heading.

A. The Regulation

It is recommended that:

1. The Regulation itself should be systems engineered to reflect an organization that clearly identifies the system engineering elements of work (products/subproducts) and the required flow of information (inputs/outputs) between them.

2. The procedures for completing each product/subproduct should be revised to fully indicate how the work is to be accomplished, as well as what work is to be accomplished, i.e., the Regulation should provide "how-to-do-it" procedures where such information does not already exist in the literature. Where such information exists, it should be specifically cited.

3. Before compromises are made due to time and resource limitations, the Regulation should require documentation of an "ideal" training program to provide justification for new resource requirements and guidance for long-term program changes.

4. The Regulation should make provisions, where necessary, for systematically reviewing, validating, and approving SEP products/subproducts by personnel who are fully aware of the nature and purpose of the SEP.

5. In defining tasks for job and training analysis, the restriction to tangible objects should be removed so that tasks involving intangible factors will not be excluded.

6. Tasks, among those not selected for school training, for which uncertainty exists regarding the correctness of their disposition, should be further analyzed to verify that no requirement exists for them to be school trained. Should such analyses reveal school training requirements for all or part of a task, provisions should be made for re-entering such tasks into the SEP.

7. Training quality control should be oriented more toward the use of field performance data and should provide systematic procedures for feeding corrective actions back into the training program.

8. Procedural guidance for testing should be clarified and re-oriented toward distinguishing between minimally acceptable and unacceptable job entry level students.

B. SEP Personnel

It is recommended that:

1. Education Advisors be added to the SEP in numbers sufficient to provide CDGs with the technical systems engineering guidance required on a day-to-day basis.

2. Policies for assignment of personnel to CDGs should be established, assuring sufficient levels of both field and instructional experience within each CDG.

3. Personnel turnover problems should be decreased by requiring long-term assignments for senior level personnel, which will maintain continuity within each CDG.

4. Systems engineering and training technology references should be made readily available to each CDG by establishing a library of these materials in the CDGs' location at each participating school.

5. USCONARC support of the SEP should be improved by providing close expert systems engineering guidance to SEP administrators and Education Advisors, and by scheduling regular meetings with them to discuss SEP progress.

6. Since CDG knowledge and experience in the mechanics of training technology is highly limited, CDGs should have access to the specialized training expertise required to accomplish the SEP milestone at hand.

Appendix A

USCONARC EDUCATION AND TRAINING RESEARCH LETTER

This appendix presents the ETRD letter requesting HumRRO Division No. 6 (Aviation) to explore with USAAVNS ways in which USCONARC schools can be assisted in their implementation of USCONARC Regulation 350-100-1.

C O P Y

DEPARTMENT OF THE ARMY
HEADQUARTERS UNITED STATES CONTINENTAL ARMY COMMAND
FORT MONROE, VIRGINIA 23351

ATIT-RD-RD

Dr. W. W. Prophet
Director of Research
HumRRO Division No. 6 (Aviation)
Fort Rucker, Alabama 36360

Dear Dr. Prophet:

For some time we have been aware of difficulty on the part of some USCONARC Schools to implement CON Reg 350-100-1. Though most information reaching us is oral and informal, a strong impression is developed by reading the research requests received in response to our last "Dragnet." The effort requested clearly reflects a dearth of the expertise needed for effective and timely implementation of the regulation. Thus, we have been considering ways in which the USCONARC Schools could be assisted in carrying out their responsibilities as specified in CON Reg 350-100-1, Systems Engineering of Training (Course Design).

Some of the prospective areas we have under consideration include: the assembly of a library of technical reports or publications pertaining to systems engineering which could be sent to all USCONARC Schools; recommending the establishment of an additional course on systems engineering management procedures to the schools directorate; and through training R&D efforts develop a "how-to-do-it" manual on systems engineering. Exploratory Study 75, currently underway at Division #2 could conceivably include these points.

We would appreciate it if you would explore these ideas with representatives of the US Army Aviation School at Fort Rucker. Any recommendations, comments, and other information regarding systems engineering of training which we, as training researchers, could use to advance systems engineering efforts throughout USCONARC would be appreciated.

Sincerely,

/s/

EDWARD M. HUDAK
Colonel, GS
Chief, ETRD Division

Appendix B

CDG Interview Outline

This appendix presents the list of questions employed by HumRRO Division No. 6 (Aviation) researchers during the CDG interviews. The questions were derived from informal interviews of USAAVNS SEP administrative personnel and initial review of the Regulation. These questions were used as a guide to insure systematic coverage of topic areas during each CDG interview, but were in no manner intended to limit the depth or range of topics covered.

CDG INTERVIEW OUTLINE

I. Background Information

A. Rank
A1. Duty position
A2. Time in service

B. Educational background

	R/W	F/W
B1. Rated		
B2. Total hours		
B3. Combat hours		
B4. IP hours		

B5. Platform instruction
B6. Time in present MOS
B7. Time as a systems engineer
B8. Any other previous assignment useful as background for systems engineering of curriculum?

II. CDG Personnel

A. How many men originally composed your group?
A1. How many men are now in your group?

B. What prerequisites are required for assignment to a CDG?
B1. What prerequisites should be required?
B2. Do you feel qualified?
B3. Do the other members in your group feel qualified?
B4. What is their background, relevant to systems engineering of curriculum development?

C. How could the staffing of CDG's realistically be improved (number of men, their backgrounds, other)?
C1. Who could implement such a change (DA, CONARC, AC, educational advisor, DOI, Departments, CDG leaders)?

D. How much turnover has there been within your CDG? Has turnover had any affect on your SE effort?
D1. What type of orientation does each new CDG member receive?
D2. How long does it take for a new man to become familiar with the job so that he is of real value to the group?

E. Do you think a short course on systems engineering for new men would be beneficial?

II. CDG Personnel (Cont'd)

F. What advantages do you think should result in aviation school training as a result of systems engineering?

F1. What do the other group members think?

III. CDG Interactions

A. As a leader or member of your CDG, what problems have you encountered in the administration of the systems engineering effort?

B. In what ways does your group interact with other CDG's, e.g., methods, problems?

C. To what extent are the sub-products standardized between CDG's?

D. Is there unnecessary duplication of effort between CDG's that could be avoided? How?

E. To whom is your group directly responsible?

F. Is technical guidance available when you need it?
F1. Who provides this technical guidance?

G. To what extent do you utilize information from the existing course?

H. In your systems engineering effort, how much and what kinds of contact have you had with your department?

I. When you finally present them the systems engineered course, what sort of reactions do you expect from your department, the school, and CONARC?
I1. What could be done to increase the probability of acceptance?

IV. 350-100-1

A. What phase of systems engineering are you now in?
A1. According to your schedule, when should you be finished systems engineering the course?

B. How well have you been able to follow 350-100-1 step by step?

C. What is the greatest benefit 350-100-1 offers systems engineering of curriculum development?

D. Are you familiar with USAAVNS Supplement 1 to 350-100-1?
D1. Are you aware of any needed improvements or clarifications?

IV. 350-100-1 (Cont'd)

E. What systems engineering references are you using?
E1. Are the references listed in 350-100-1 available? Where? Have you found them useful?
E2. What other systems engineering references have you found useful?

F. Task Inventory (pp 12-15)

1. How did you go about selecting your initial list of tasks? How many did you end up with?

2. Is 350-100-1's definition of the word "task" adequate to describe the elements of the job? (p 12)

3. Do you feel each task was adequately described using action verbs, objects, and qualifiers as classifications?
3a. To what extent were qualifiers necessary in describing the task?

4. Were you provided a glossary of action verbs? Were they satisfactory?

5. Did your list have tasks in common with those of other CDG's? Could you save manpower by combining these tasks somehow? How?

6. Was any task omitted from your task inventory that you think should have been included? If yes, why?

7. Did anyone validate your task inventory? Did they make additions or deletions? What method did they use? (Milestone 2)

8. If you were about to start this again, how would you go about composing your task inventory?

G. Selecting tasks for training (pp 21-23)

1. How did you go about selecting the tasks for school training, e.g., methods, criteria, rationale?

2. How many tasks did you wind up with? Looking back, is there any method you could have used to obtain a smaller but still inclusive <u>initial</u> task listing?

3. Did anyone other than DOI review your task list?
3a. What method of review did they use?
3b. Did they make additions or deletions?

IV. 350-100-1 (Cont'd)

4. Did your department review your task list?
4a. What was their reaction?

5. What was the outcome of the DOI review?

H. Job task data cards (JTDC)

1. For each task you selected for school training, do you have one or more JTDC('s)?

2. Did you have to prepare JTDC's for any tasks not listed for school training?

3. Now that you have experience in preparing JTDC's, would you make any changes in the way you prepared your list of tasks for school training?

4. How many JTDC's did you end up with?

5. What problems, if any, did you have preparing the JTDC's?

6. How did you group the tasks prior to writing the JTDC's?

7. How did you go about defining and selecting the skills and knowledges for each task?
7a. Did any skills and knowledges or attitudes require school training? Did you write JTDC's for them?

8. Did you experience any difficulty defining and selecting the job conditions and standards?

9. Did your department review the JTDC's?
9a. What was their reaction?

10. What was the outcome of DOI's review of your JTDC's? (Milestone 7)

I. Training analysis information sheets (TAIS)

1. How far along are you in the preparation of the TAIS's? How many do you expect to finish with? When do you expect to complete the TAIS's?

2. Did you/are you prepare(ing) page 2 (lesson analysis) of the TAIS concurrently with page 1?

IV. 350-100-1 (Cont'd)

3. Training Objectives

   a. How helpful have the JTDC's been in preparing the training objectives portion of the TAIS?

      (1) Were the tasks and sub-tasks, the conditions and standards described on the JTDC defined in sufficient detail for training objective preparations?

   b. Have you prepared separate TAIS's for any supporting skills or knowledges and attitudes?

      (1) Had these previously been described on a separate JTDC?

   c. How did you decide whether the training standard should be (1) equal to, (2) less than, (3) or exceed the job standard? (p 33)

   d. Have you had any difficulty incorporating attitudes into the training standard? If so, did you prepare TAIS's for them?

   e. How helpful has CON Pamphlet 350-14 been to you in preparing training objectives?

4. Criteria (p 34)

   a. Have you had any difficulty in determining the criteria for each TAIS?

   b. To what extent have they differed from the training objectives?

5. Review of Training Objectives and Criteria by DOI (Milestone 9)

   a. What was the outcome of the DOI review?

6. Development of Course Structure - CLUSTERING (pp 35-42)

   a. What difficulties, if any, have you had in arranging the training objectives into a course structure?

   b. Do you think the CONARC Reg describes the procedures for doing this sufficiently well?

IV. 350-100-1 (Cont'd)

7. Lesson Analysis - Page 2 of TAIS (pp 45-49)

a. What problems, if any, did you have in preparing page 2 of the TAIS's?

(1) teaching points (learning elements) (p 46)

(2) references (p 46)

(3) methods of instruction (pp 46-47)

(4) media (pp 47-48)

(5) training equipment material (p 48)

(6) training facilities (p 48)

(7) estimate of time

b. Did you receive any assistance from your department in completing page 2 of the TAIS?

c. To what extent did you use the existing program as a guide?

d. Do you feel that you and your group have the background and training to do a satisfactory job of completing page 2 of the TAIS's?

e. Have you found any particular reference material useful in completing this phase of the SE? What?

J. Recommended Location of Training (Milestone 12)

1. Do you feel qualified to recommend the location of the training?

2. Did you have any problems in accomplishing this milestone?

K. Approval of Completed TAIS and Location of Training (Milestone 13)

1. What was the outcome of the DOI review?

Appendix C

CONSENSUS STATEMENTS BY TOPIC AREA FROM CDG INTERVIEWS

The statements presented in this appendix reflect a consensus of CDG opinion about the SEP and the mechanics of implementing USCONARC Regulation 350-100-1, as consolidated from the CDG interviews by HumRRO Division No. 6 (Aviation) researchers. It should be emphasized that these statements represent unofficial opinions of individual CDG members, and not necessarily the official opinion of USAAVNS or its SEP personnel. However, the insight provided by these statements regarding the problems and potential solutions for implementing USCONARC Regulation 350-100-1 formed the primary basis of many of the items in the Results section (Chapter III).

CONSENSUS STATEMENTS BY TOPIC AREA FROM CDG INTERVIEWS

A. CDG MEMBERSHIP BACKGROUND

1. Originally CDG slots were filled mainly with majors and captains, but now are a few majors and mostly captains, warrant officers, and enlisted personnel.

2. Most CDG's lack academic capability in terms of platform instruction, lesson planning, and work organization.

3. There appear to be no guidelines in the Regulation or from CONARC concerning prerequisite qualifications for CDG personnel.

4. Most CDG members have Vietnam experience but beyond that overseas experience is limited and could yield a course designed primarily for Vietnam.

5. Six CDG personnel (one major, four captains, and an E-4 Clerk-Typist) have recently been assigned to help DOI administration of the SEP, but the SEP Educational Advisor will have to train them extensively before they can reduce his work load.

B. IDEAL LENGTH OF PERSONNEL ASSIGNMENT

1. Stabilized personnel assignment is of utmost importance for maintaining adequate CDG performance.

2. With a year's SEP experience, it was speculated that a CDG could SE a course in one year's time.

3. Duration of assignment should be at least until the course is systems engineered.

4. Best possible assignment would be for the 5-year duration of the SEP.

5. Minimum assignment duration would be one year if each CDG had a systems engineering expert.

C. IDEAL CDG MEMBERSHIP BACKGROUND

1. DOI requested 83 personnel with extensive military and field experience and some platform instruction background to be assigned to CDG's at least one year before being due for reassignment.

C. IDEAL CDG MEMBERSHIP BACKGROUND (Cont'd)

2. USAAVNS requested 39 slots that would come from the departments existing staffs, but CDGs' present military, field, and academic background indicates that the best qualified personnel are assigned to flight line duty.

3. The ideal CDG member would have the background requested by DOI (item 1) plus experience in course development including curriculum planning and writing lesson plans in that phase of Army aviation in which he is developing a course.

D. IDEAL CDG COMPOSITION

1. All CDG members should have an introductory course in SE and be supported by a systems engineering expert in each CDG or at least one for each department.

2. Greater cooperation and freer expression of ideas may result if each CDG member "leaves his rank at the door."

3. Each member should be freed of outside duties that detract from his part in the SE effort; adequate equipment and secretarial support should be assured.

E. PERSONNEL TURNOVER WITHIN CDG's

1. Any turnover within a CDG results in a complete loss of the man's experience because no provisions are made for passing his knowledge on.

2. There has been a case of 100% turnover within a CDG, and such rates of turnover result in confusion when CDG members try to find reasons for a completed step being done as it was.

3. High rates of turnover severely reduce the systems engineering expertise level within CDG's and appear largely due to normal DA assignment policy for aviators on short tours.

F. ORIENTATION OF NEW CDG MEMBERS TO THE SEP

1. Each new member is given copies of CON Reg 350-100-1 and CON Pamphlet 350-14. Some members indicate little use of 350-14 and others are unfamiliar with it.

F. ORIENTATION OF NEW CDG MEMBERS TO THE SEP (Cont'd)

2. The Systems Engineering Workshop is only marginally useful because of its supervisory orientation and lack of working level specifics.

3. Coverage provided in the TV tape briefing on CON Reg 350-100-1 is so broad that it serves only as a general orientation to the SEP.

4. The DOI briefings provided just prior to each SE step are of little help; day-to-day guidance is required.

5. CDG members receive their most useful orientation in the one to three months required for them to become familiar with the SEP and productive CDG members.

G. SUGGESTIONS FOR ORIENTATION OF NEW CDG MEMBERS

1. As a minimum, each CDG suggested the addition of one systems engineering expert in each department.

2. USAAVNS Supplement to CON Reg 350-100-1 could be revised to include examples of typical aviation tasks carried through each working level step in the SE process.

3. All CDG's suggested a formal introductory course in systems engineering aimed specifically at implementation of CON Reg 350-100-1.

H. ADMINISTRATIVE PROBLEMS OF THE CDG

1. CDG leaders express reservations about writing proficiency reports on higher ranking members of the CDG and on members from different departments.

2. A lack of command support required from departments, DOI, and higher headquarters is reported.

3. This lack of interest in the SEP makes it difficult to maintain morale and motivation within CDG's and contributes to the feeling that the SEP will bog down due to a lack of backing.

4. Concerning implementation of CON Reg 350-100-1, improvement in communication between CDG's and DOI appears indicated.

5. It was reported that scheduled coordination meetings between the systems engineering groups of the various CONARC schools would be highly beneficial toward resolving mutual problems.

I. TECHNICAL GUIDANCE FROM DOI

1. The DOI review system is a bottleneck that retards CDG progress such that CDG's admit they write SEP products in a way that will assure DOI approval.

2. DOI is severely understaffed to perform review and technical guidance functions.

3. CDG's are infrequently able to schedule meetings with DOI's SEP Educational Advisor because of his overwhelming work load, and as a result CDG's get off the track in their SE efforts.

4. Day-by-day technical guidance at the CDG level is mandatory to keep CDG's "on the track."

J. INTERACTIONS BETWEEN CDG's AND THEIR DEPARTMENTS

1. CDG's operate from the Operations and Plans Branch of their departments and departmental contact is minimized to maintain SEP independence.

2. CDG leaders are authorized direct contact with their departmental director except for DOMT where an Education Specialist coordinates the SEP and supervises DOMT personnel in CDG's.

3. ATC/CDG's cannot maintain independence of their department because the department is only 15 members strong and all are required in the SEP.

4. Realization of the SEP's full impact is lacking within the departments and CDG's doubt departmental acceptance of the systems engineered course. This flaw in the SEP could be remedied by command emphasis from the AC to departmental directors.

K. COMMENTS ON CON REG 350-100-1 (the Reg)

1. In a particular SE step, all CDG members may have the same end-product in mind but the Regulation often does not clearly define a given point and allows justification of several opinions.

2. CDG's tend to work on each step of the SEP as a solitary unit and lose sight of the interdependence among steps; the Reg should be broken down into a system of well-defined step by step procedures with emphasis on a "chain-link" process of development.

K. COMMENTS ON CON REG 350-100-1 (the Reg) (Cont'd)

3. Almost all courses require specific SE orientation and the Reg does not provide sufficient guidance along these lines. USAAVNS Supplement to the Reg could be adapted to provide 15 or so complete examples of tasks taken step by step through the SE process.

L. DEVELOPMENT OF THE TASK MATRIX AND TASKS FOR SCHOOL TRAINING

1. The Reg's definition of a task was global and open for various interpretations both within and between CDG's.

2. In addition to DOI's list of action verbs, each CDG developed terms suiting its particular work area. However, the scope of verbs selected varied between CDG's from specific to global, leading to non-standardized task descriptions.

3. Little use was made of qualifiers on the task matrix; a qualification statement would have been the minimum required.

4. DOI review of the task matrix and tasks selected for school training was of little help but the departmental validation provided some inputs.

M. PREPARATION OF JTDC's

1. A JTDC should be written for each task, skill and knowledge requiring school training.

2. When a skill and knowledge results in a JTDC and becomes a TAIS, it should be sequenced before the task for which it is a required skill and knowledge.

3. The treatment of skills and knowledges is not adequately defined in the Reg for most CDG's and confusion results when skills and knowledges are transformed into tasks, training objectives, and sometimes teaching points.

4. The attitude element of JTDC's is seldom used and it is also missed. It was reported that DOI instructed CDG's to include attitudes on page 2 of the TAIS whereas separate TAIS's should be written for attitudes requiring training, according to the Reg.

5. Some CDG's have had to revise their task matrices after they started writing JTDC's because some tasks were too global and others too specific.

N. PREPARATION OF TAIS's: PAGE 1

1. Some CDG's found that JTDC's did not contain sufficient information about the tasks, skills and knowledges, job conditions, and attitudes requiring school training to prepare training objectives on the TAIS.

2. The content of a TAIS page 1 may easily result in more than one TAIS page 2.

3. CON Pamphlet 350-14 has been referred to in writing training objectives but has not proved worthwhile as a supplement to the Reg.

4. Difficulty was experienced when job standards were altered for testing purposes. It was hard to develop test standards adequately reflecting performance standards. This again reflects a failure of the Reg to indicate the dependency of one SE step on another step.

5. CDG's displayed concern about the meaning of training standards, e.g., standards should reflect entry-level performance but it is difficult to evaluate graduation-day level performance when the test was passed months before with no practice since.

O. PREPARATION OF TAIS's: PAGE 2

1. It was indicated that sequencing of TAIS page 1's presents problems, e.g., how to sequence a troubleshooting task; the effect of sequencing page 1's on the sequence of page 2's; and the effect on sequenced page 1's of TAIS's written for practical exercises (PE) during page 2 preparation.

2. Each CDG has been instructed by DOI to program a PE for the end of each five-hour block of instruction and to prepare a TAIS for each PE.

3. Since no written definition or instructions for employment of PE's was given, it remains the option of each CDG whether the PE will be a test, a demonstration, and/or student practice on the task.

4. The expectation of writing PE's is influencing the writing of TAIS's.

5. There is a danger that estimated times for teaching points may become real times when the POI is submitted.

6. Estimated teaching point time does not allow for setting up before or cleaning up after PE's, closing out hour sessions within a large teaching block, or review at the end of instruction periods. Estimated times should remain estimates until feedback is available to realistically change teaching point times.

O. PREPARATION OF TAIS's: PAGE 2 (Cont'd)

7. CDG's should request best possible media, aids, training equipment, and facilities, but some have reported instructions to request what is available unless they were prepared to develop it themselves.

8. Some CDG members feel the departments are better prepared to write page 2 of the TAIS, but with CDG supervision.

9. Selection of training sites may be done with the best possible training site in mind but power struggles are foreseen in the final selection.

Appendix D

CDG BACKGROUND QUESTIONNAIRE

The content of this questionnaire was based on information obtained from initial review of USCONARC Regulation 350-100-1, and from interviews with USAAVNS SEP administrative and CDG personnel. The questionnaire was intended to sample those elements of individual CDG members' experience and training considered most relevant to performance as a CDG member. It was from the results of this questionnaire that much of the information about CDG personnel, presented in the Results section (Chapter III), was obtained.

HumRRO Division No. 6 (Aviation)
Ft. Rucker, Alabama

HumRRO Systems Engineering Questionnaire

USCONARC has requested that HumRRO, Division No. 6 (Aviation) conduct a survey of systems engineering personnel assigned to USAAVNS CDGs. The purpose of the survey is to provide USCONARC with recommendations on actions they can take to improve implementation of CON Reg 350-100-1 throughout the USCONARC school system. In addition to talking with each CDG, it is necessary to obtain information concerning the background and experience of individual CDG members. Therefore, please complete the questions listed below as accurately as possible. Feel free to add additional comments you consider to be of value to our survey. Please return to R. Schulz, HumRRO Div. #6 (Avn.), Bldg. 501.

A. BACKGROUND

1. Name_____

2. Rank or GS_____

3. Total time in all branches of active federal military service

_____years, months.

4. Branch of service_____

5. Primary MOS_____

6. Department to which assigned_____

7. Indicate the number of tours you have served in each of the geographical areas listed below:

_____Europe

_____Vietnam

_____Korea

_____Hawaii

_____Alaska

_____Canal Zone

_____Other geographical areas (specify) _____

_____

B. TRAINING

1. How many years of civilian education nave you completed? (Include GED.)

_____less than 12 years

_____high school graduate

_____college--less than two years._____major.

_____college--two years or more._____major.

_____college degree._____major.

2. Indicate all military training you have received.

_____MOI

_____Systems engineering workshop

Other (specify)

_____

_____

_____

_____

_____

C. TEACHING EXPERIENCE

1. Indicate all courses in which you have instructed. For each include the length of time you instructed and type of instruction you gave (e.g., academic, PE, IP, etc.).

Course	Time as Instructor	Type of Instructor

D. FLIGHT EXPERIENCE

1. Indicate the aircraft in which you are a rated aviator. For each, include the approximate (1) total hours flown, (2) total combat hours flown, and (3) total IP hours.

Aircraft	Total Hours	Combat Hours	IP Hours

E. MAINTENANCE EXPERIENCE

1. Have you ever been a maintenance officer_____

2. Indicate the aircraft for which you have enlisted maintenance experience. Include type of experience.

Aircraft	Mech-anic	Crew Chief	Super-visor	Tech. Insp.

F. ATC EXPERIENCE

1. Indicate any ATC experience that you have.

G. CDG EXPERIENCE

1. Indicate all CDG's to which you have been assigned. Include MOS being systems engineered and approximate dates of assignment.

CDG	MOS	Approx. Dates of Assignment

Appendix E

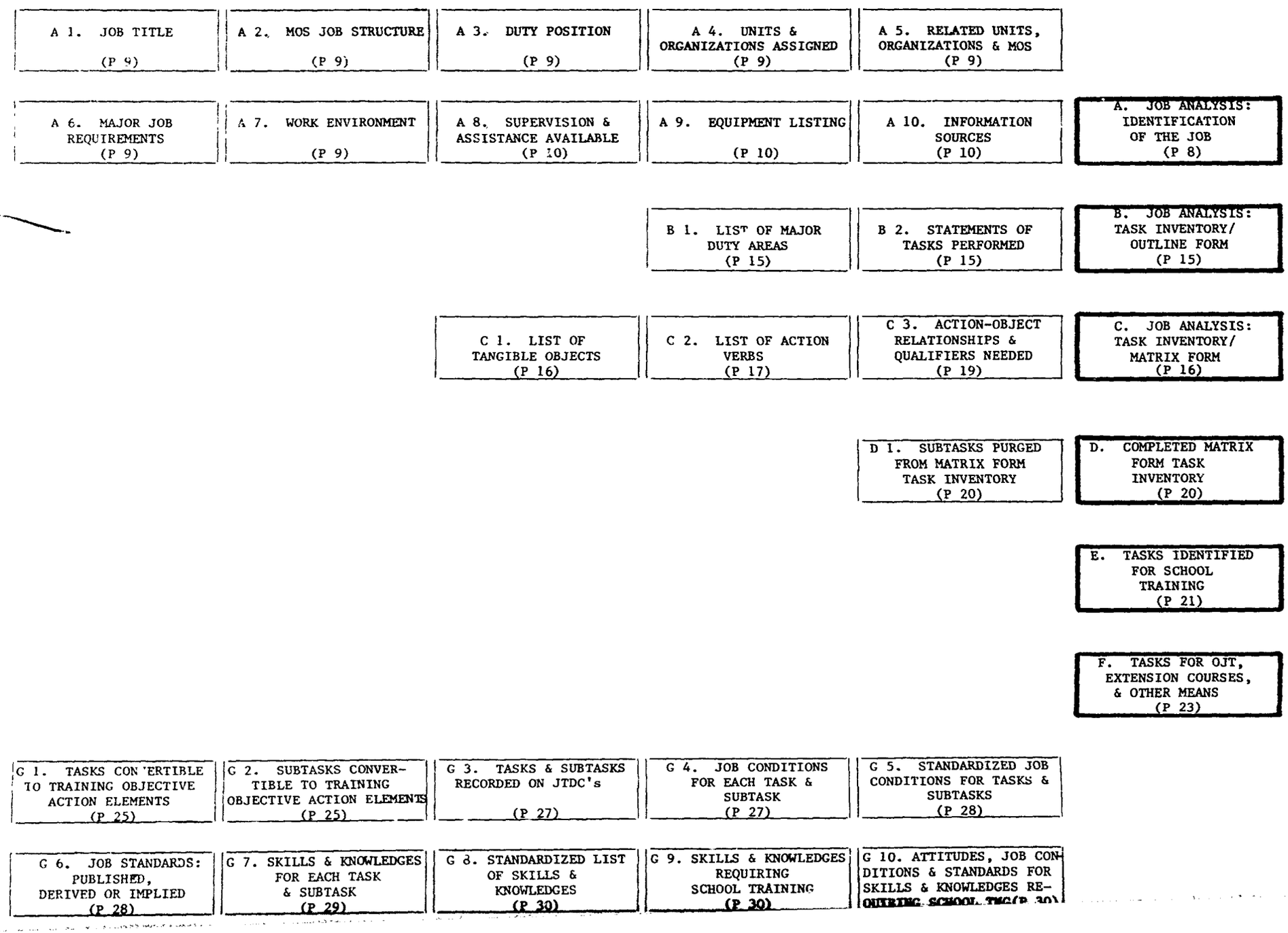
PRODUCT/SUBPRODUCT BLOCK FLOW DIAGRAM

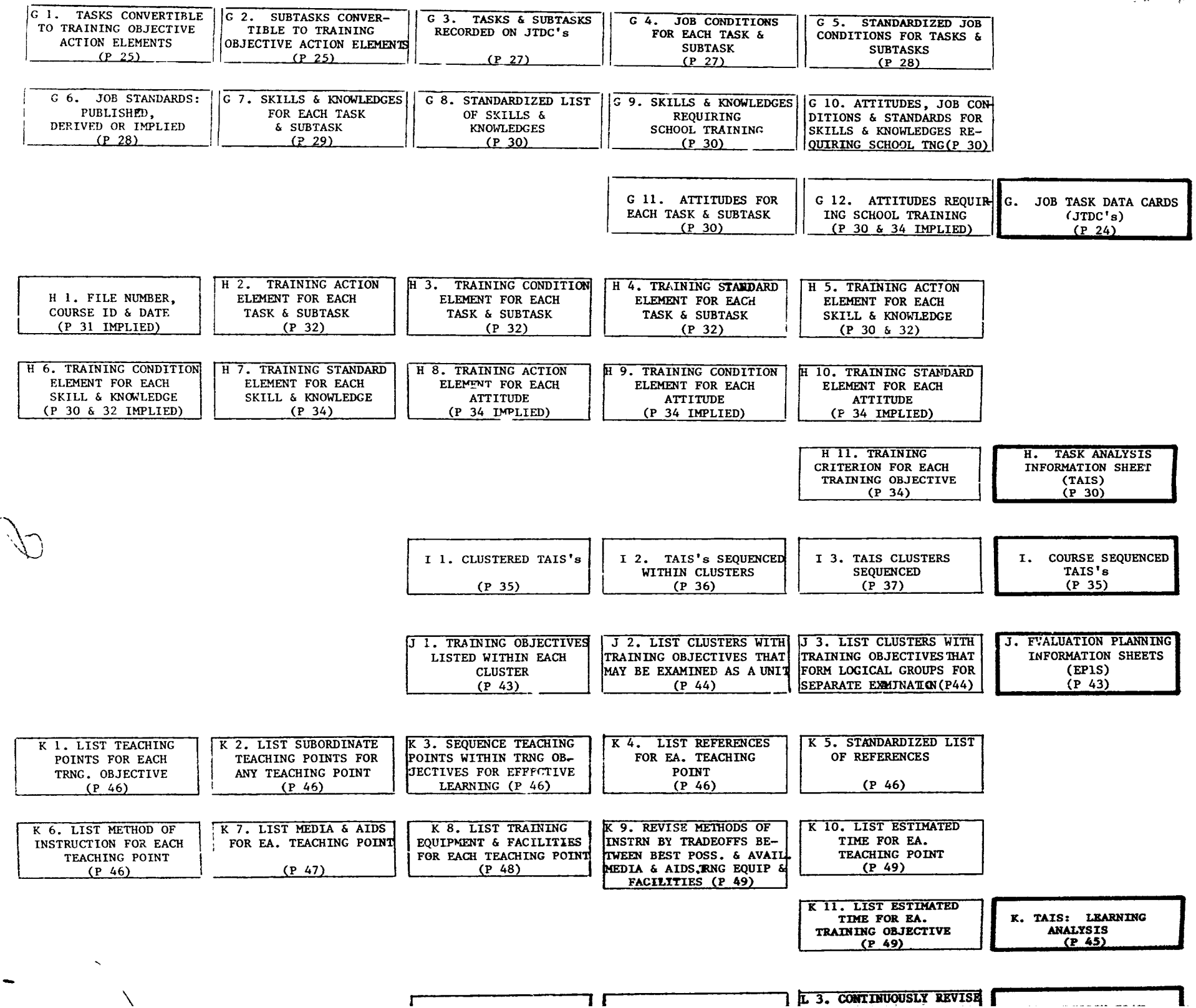
This appendix presents results of the first step taken in detailed analysis of the systems engineering process described in USCONARC Regulation 350-100-1. Systems engineering is a product oriented concept, so HumRRO Division No. 6 (Aviation) researchers broke the process down into products and subproducts, since these were not clearly evident in USCONARC Regulation 350-100-1. Products were defined as the major units of work required to systems engineer a training program. Subproducts were defined as elements of work resulting in documented information which is required to complete a product. Both products and subproducts may yield information necessary to complete any other product or subproduct in the systems engineering process.

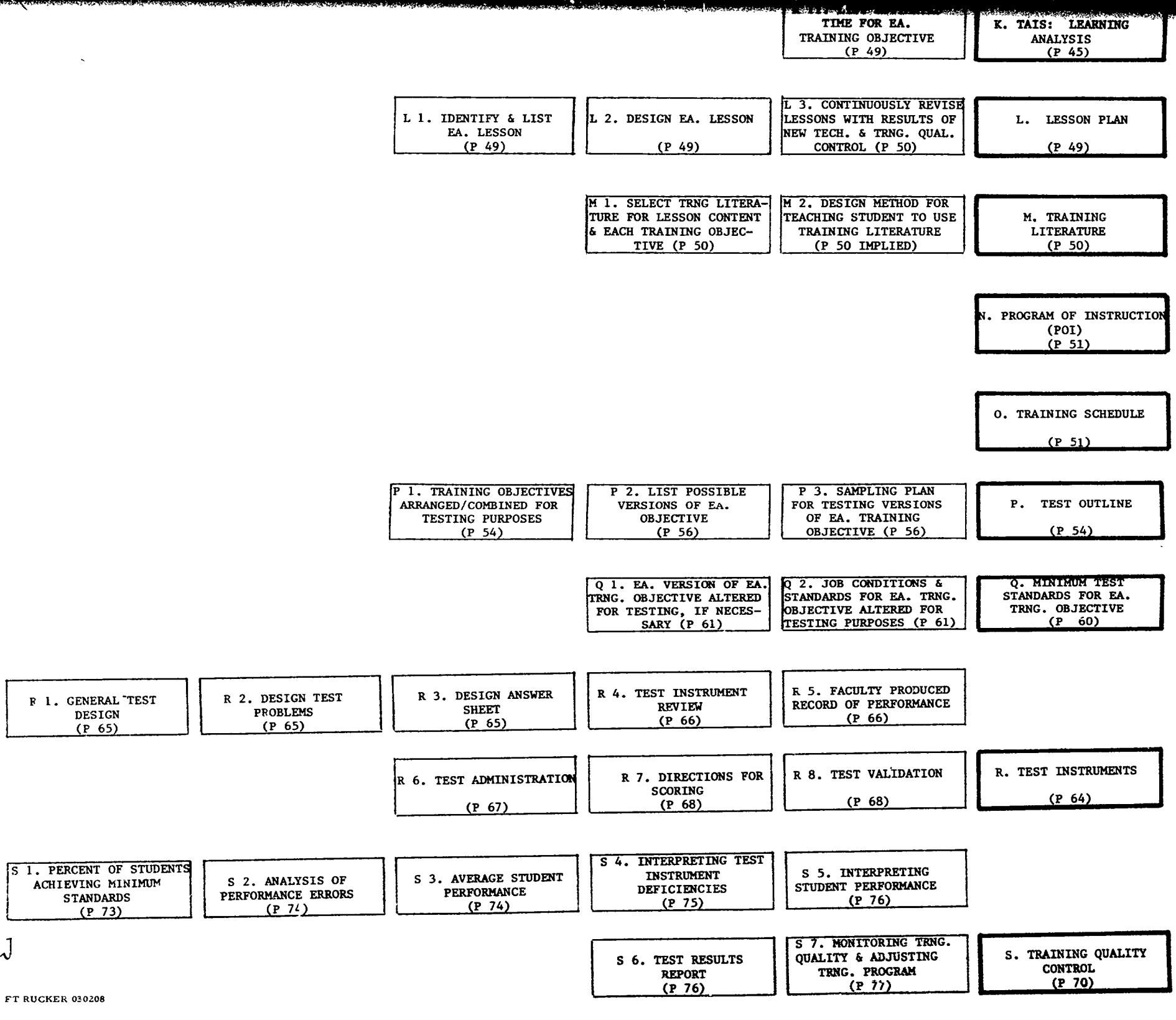
It should be emphasized that the flow diagram presents products and subproducts in the exact order as the elements of work appear in USCONARC Regulation 350-100-1, and not necessarily in the order that USAAVNS CDGs completed them or as would be recommended by the HumRRO Division No. 6 (Aviation) researchers. In the diagram, subproducts flow from left to right, ending with the completed product, and the completed products flow from top to bottom. Page numbers refer to the location of each product/subproduct in USCONARC Regulation 350-100-1, and the alphanumeric coding is that adopted for this study.

This block flow diagram, by identifying each product and subproduct in the order it is to be completed, illustrates the sequential nature of the systems engineering of training process. This graphic overview of the entire process was found to be a useful reference, almost on a daily basis, for HumRRO Division No. 6 (Aviation) researchers in analyzing USCONARC Regulation 350-100-1. Therefore, it is believed that SEP personnel at various levels would find this graphic presentation of the process useful in their work, and it is suggested that consideration be given to including it in any future revision of USCONARC Regulation 350-100-1.

PRODUCT/SUBPRODUCT BLOCK FLOW DIAGRAM




G 1. TASKS CONVERTIBLE TO TRAINING OBJECTIVE ACTION ELEMENTS (P 25)
G 2. SUBTASKS CONVERTIBLE TO TRAINING OBJECTIVE ACTION ELEMENTS (P 25)
G 3. TASKS & SUBTASKS RECORDED ON JTDC's (P 27)
G 4. JOB CONDITIONS FOR EACH TASK & SUBTASK (P 27)
G 5. STANDARDIZED JOB CONDITIONS FOR TASKS & SUBTASKS (P 28)
G 6. JOB STANDARDS: PUBLISHED, DERIVED OR IMPLIED (P 28)
G 7. SKILLS & KNOWLEDGES FOR EACH TASK & SUBTASK (P 29)
G 8. STANDARDIZED LIST OF SKILLS & KNOWLEDGES (P 30)
G 9. SKILLS & KNOWLEDGES REQUIRING SCHOOL TRAINING (P 30)
G 10. ATTITUDES, JOB CONDITIONS & STANDARDS FOR SKILLS & KNOWLEDGES REQUIRING SCHOOL TNG (P 30)
G 11. ATTITUDES FOR EACH TASK & SUBTASK (P 30)
G 12. ATTITUDES REQUIRING SCHOOL TRAINING (P 30 & 34 IMPLIED)
G. JOB TASK DATA CARDS (JTDC's) (P 24)
H 1. FILE NUMBER, COURSE ID & DATE (P 31 IMPLIED)
H 2. TRAINING ACTION ELEMENT FOR EACH TASK & SUBTASK (P 32)
H 3. TRAINING CONDITION ELEMENT FOR EACH TASK & SUBTASK (P 32)
H 4. TRAINING STANDARD ELEMENT FOR EACH TASK & SUBTASK (P 32)
H 5. TRAINING ACTION ELEMENT FOR EACH SKILL & KNOWLEDGE (P 30 & 32)
H 6. TRAINING CONDITION ELEMENT FOR EACH SKILL & KNOWLEDGE (P 30 & 32 IMPLIED)
H 7. TRAINING STANDARD ELEMENT FOR EACH SKILL & KNOWLEDGE (P 34)
H 8. TRAINING ACTION ELEMENT FOR EACH ATTITUDE (P 34 IMPLIED)
H 9. TRAINING CONDITION ELEMENT FOR EACH ATTITUDE (P 34 IMPLIED)
H 10. TRAINING STANDARD ELEMENT FOR EACH ATTITUDE (P 34 IMPLIED)
H 11. TRAINING CRITERION FOR EACH TRAINING OBJECTIVE (P 34)
H. TASK ANALYSIS INFORMATION SHEET (TAIS) (P 30)
I 1. CLUSTERED TAIS's (P 35)
I 2. TAIS's SEQUENCED WITHIN CLUSTERS (P 36)
I 3. TAIS CLUSTERS SEQUENCED (P 37)
I. COURSE SEQUENCED TAIS's (P 35)
J 1. TRAINING OBJECTIVES LISTED WITHIN EACH CLUSTER (P 43)
J 2. LIST CLUSTERS WITH TRAINING OBJECTIVES THAT MAY BE EXAMINED AS A UNIT (P 44)
J 3. LIST CLUSTERS WITH TRAINING OBJECTIVES THAT FORM LOGICAL GROUPS FOR SEPARATE EXAMINATION (P44)
J. EVALUATION PLANNING INFORMATION SHEETS (EPIS) (P 43)
K 1. LIST TEACHING POINTS FOR EACH TRNG. OBJECTIVE (P 46)
K 2. LIST SUBORDINATE TEACHING POINTS FOR ANY TEACHING POINT (P 46)
K 3. SEQUENCE TEACHING POINTS WITHIN TRNG OBJECTIVES FOR EFFECTIVE LEARNING (P 46)
K 4. LIST REFERENCES FOR EA. TEACHING POINT (P 46)
K 5. STANDARDIZED LIST OF REFERENCES (P 46)
K 6. LIST METHOD OF INSTRUCTION FOR EACH TEACHING POINT (P 46)
K 7. LIST MEDIA & AIDS FOR EA. TEACHING POINT (P 47)
K 8. LIST TRAINING EQUIPMENT & FACILITIES FOR EACH TEACHING POINT (P 48)
K 9. REVISE METHODS OF INSTRN BY TRADEOFFS BETWEEN BEST POSS. & AVAIL. MEDIA & AIDS, TRNG EQUIP & FACILITIES (P 49)
K 10. LIST ESTIMATED TIME FOR EA. TEACHING POINT (P 49)
K 11. LIST ESTIMATED TIME FOR EA. TRAINING OBJECTIVE (P 49)
K. TAIS: LEARNING ANALYSIS (P 45)
L 3. CONTINUOUSLY REVISE



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Appendix F

INPUT/OUTPUT OUTLINE FORM ANALYSIS

This appendix presents results of the second step taken in detailed analysis of USCONARC Regulation 350-100-1. The systematic flow of information between the products/subproducts listed in Appendix E was determined to be a critical factor in systems engineering of training. However, this flow of information, or input-output links between products/subproducts, was not fully evident from study of USCONARC Regulation 350-100-1, and full awareness of these input-output links was found essential for optimal completion of products/subproducts. Thus, these links were divided into input information required by each product/subproduct from other products/subproducts, and output information from each product/subproduct required by other products/subproducts.

The inputs and outputs are listed in this appendix as they are required or implied by USCONARC Regulation 350-100-1 for completion of each product or subproduct. Product/subproduct page numbers refer to their location in USCONARC Regulation 350-100-1.

Since full awareness of inputs/outputs for each product/subproduct is crucial for optimal systems engineering of training, any revised edition of USCONARC Regulation 350-100-1 should clearly indicate the inputs and outputs required by each product/subproduct.

INPUT/OUTPUT OUTLINE FORM ANALYSIS

Product and Sub-Product	Inputs	Outputs
A 1. Job Title (P 9)	A 10. Information Sources C. Job Analysis: Task Inventory/Matrix Form	H 1. File Number, Course ID, and Date
A 2. MOS Job Structure (P 9)	A 10. Information Sources	Not Identified
A 3. Duty Position (P 9)	A 10. Information Sources	Not Identified
A 4. Units and Organizations Assigned (P 9)	A 10. Information Sources	Not Identified
A 5. Related Units, Organizations, and MOS (P 9)	A 10. Information Sources	Not Identified
A 6. Major Job Requirements (P 9)	A 10. Information Sources	B. Job Analysis: Task Inventory/Outline Form B 2. Statements of Tasks Performed C 1. List of Tangible Objects C 2. List of Action Verbs C 3. Action-Object Relationships and Qualifiers Needed D. Completed Matrix Form Task Inventory G 4. Job Conditions for Each Task and Subtask G 10. Attitudes, Job Conditions and Standards for Skills and Knowledges Requiring School Training G 11. Attitudes for Each Task and Subtask H 4. Training Standard Element for Each Task and Subtask H 9. Training Condition Element for Each Attitude K 4. List References for Each Teaching Point K 6. List Method of Instruction for Each Teaching Point K 7. List Media and Aids for Each Teaching Point P 2. List Possible Versions of Each Training Objective R 1. General Test Design R 2. Design Test Problems R 3. Design Answer Sheet
A 7. Work Environment (P 9)	A 10. Information Sources	B. Job Analysis: Task Inventory/Outline Form C 1. List of Tangible Objects C 2. List of Action Verbs C 3. Action-Object Relationships and Qualifiers Needed G 4. Job Conditions for Each Task and Subtask G 10. Attitudes, Job Conditions and Standards for Skills and Knowledges Requiring School Training G 11. Attitudes for Each Task and Subtask H 9. Training Condition Element for Each Attitude K 4. List References for Each Teaching Point K 6. List Method of Instruction for Each Teaching Point K 7. List Media and Aids for Each Teaching Point P 2. List Possible Versions of Each Training Objective R 1. General Test Design R 2. Design Test Problems R 3. Design Answer Sheet

Product and Sub-Product	Inputs	Outputs
A 8. Supervision and Assistance Available (P 10)	A 10. Information Sources	B. Job Analysis: Task Inventory/Outline Form C 1. List of Tangible Objects C 2. List of Action Verbs C 3. Action-Object Relationships and Qualifiers Needed G 4. Job Conditions for Each Task and Subtask G 10. Attitudes, Job Conditions and Standards for Skills and Knowledges Requiring School Training G 11. Attitudes for Each Task and Subtask H 9. Training Condition Element for Each Attitude K 4. List References for Each Teaching Point K 6. List Method of Instruction for Each Teaching Point K 7. List Media and Aids for Each Teaching Point P 2. List Possible Versions of Each Training Objective R 1. General Test Design R 2. Design Test Problems R 3. Design Answer Sheet
A 9. Equipment Listing (P 10)	A 10. Information Sources	B. Job Analysis: Task Inventory/Outline Form C 1. List of Tangible Objects C 2. List of Action Verbs C 3. Action-Object Relationships and Qualifiers Needed G 4. Job Conditions for Each Task and Subtask G 10. Attitudes, Job Conditions and Standards for Skills and Knowledges Requiring School Training G 11. Attitudes for Each Task and Subtask H 9. Training Condition Element for Each Attitude K 4. List References for Each Teaching Point K 6. List Method of Instructions for Each Teaching Point K 7. List Media and Aids for Each Teaching Point P 2. List Possible Versions of Each Training Objective R 1. General Test Design R 2. Design Test Problems R 3. Design Answer Sheet
A 10. Information Sources (P 10)	C. Job Analysis: Task Inventory/ Matrix Form	A 1. Job Title A 2. MOS Job Structure A 3. Duty Position A 4. Units and Organizations Assigned A 5. Related Units, Organizations and MOS A 6. Major Job Requirements A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing B. Job Analysis: Task Inventory/Outline Form B 1. List of Major Duty Areas B 2. Statements of Tasks Performed C 1. List of Tangible Objects C 2. List of Action Verbs C 3. Action-Object Relationships and Qualifiers Needed G 4. Job Conditions for Each Task and Subtask G 6. Job Standards: Published, Derived or Implied G 10. Attitudes, Job Conditions and Standards for Skills and Knowledges Requiring School Training G 11. Attitudes for Each Task and Subtask H 9. Training Condition Element for Each Attitude H 10. Training Standard Element for Each Attitude K 4. List References for Each Teaching Point K 6. List Method of Instruction for Each Teaching Point K 7. List Media and Aids for Each Teaching Point

Product and Sub-Product	Inputs	Outputs
A 10. Information Sources (P 10) (Cont'd)		L 2. Design Each Lesson L 3. Continuously Revise Lessons with Results of New Technology and Training Quality Control M 2. Design Method for Teaching Student to Use Training Literature N. Program of Instruction (POI) O. Training Schedule P 2. List Possible Versions of Each Training Objective P 1. General Test Design R 2. Design Test Problems R 3. Design Answer Sheet R 7. Directions for Scoring R 8. Test Validation S 1. Percent of Students Achieving Minimum Standard S 2. Analysis of Performance Errors S 3. Average Student Performance S 5. Interpreting Student Performance S 6. Test Results Report
A. Job Analysis: Identification of the Job (P 8)		
B 1. List of Major Duty Areas (P 15)	A 10. Information Sources	B. Job Analysis: Task Inventory/Outline Form
B 2. Statements of Tasks Performed (P 15)	A 6. Major Job Requirements A 10. Information Sources	B. Job Analysis: Task Inventory/Outline Form
B. Job Analysis: Task Inventory/Outline Form (P 15)	A 6. Major Job Requirements A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing A 10. Information Sources B 1. List of Major Duty Areas B 2. Statements of Tasks Performed	C 3. Action-Object Relationships and Qualifiers Needed D. Completed Matrix Form Task Inventory D 1. Subtasks Purged From Matrix Form Task Inventory
C 1. List of Tangible Objects (P 16)	A 6. Major Job Requirements A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing A 10. Information Sources	C 2. List of Action Verbs C 3. Action-Object Relationships and Qualifiers Needed D. Completed Matrix Form Task Inventory D 1. Subtasks Purged From Matrix Form Task Inventory
C 2. List of Action Verbs (P 17)	A 6. Major Job Requirements A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing A 10. Information Sources C 1. List of Tangible Objects	C 3. Action-Object Relationships and Qualifiers Needed D. Completed Matrix Form Task Inventory D 1. Subtasks Purged From Matrix Form Task Inventory
C 3. Action-Object Relationships and Qualifiers Needed (P 19)	A 6. Major Job Requirements A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing A 10. Information Sources B. Job Analysis: Task Inventory/Outline Form C 1. List of Tangible Objects C 2. List of Action Verbs	D. Completed Matrix Form Task Inventory D 1. Subtasks Purged From Matrix Form Task Inventory G. Job Task Data Cards
C. Job Analysis: Task Inventory/Matrix Form (P 16)		A 1. Job Title A 10. Information Sources
D 1. Subtasks Purged From Matrix Form Task Inventory (P 20)	B. Job Analysis: Task Inventory/Outline Form C 1. List of Tangible Objects C 2. List of Action Verbs C 3. ction-Object Relationships and Qualifiers Needed D. Completed Matrix Form Task Inventory	E. Tasks Identified for School Training F. Tasks for OJT, Extension Courses, and Other Means G 2. Subtasks Convertible to Training Objectives Action Elements R 1. General Test Design
D. Completed Matrix Form Task Inventory (P 20)	A 6. Major Job Requirements B. Job Analysis: Task Inventory/Outline Form C 1. List of Tangible Objects C 2. List of Action Verbs C 3. Action-Object Relationships and Qualifiers Needed	D 1. Subtasks Purged From Matrix Form Task Inventory E. Tasks Identified for School Training F. Tasks for OJT, Extension Courses, and Other Means

Product and Sub-Product	Inputs	Outputs
E. Tasks Identified for School Training (P 21)	D. Completed Matrix Form Task Inventory D 1. Subtasks Purged From Matrix Form Task Inventory	G 1. Tasks Convertible to Training Objective Action Elements G 2. Subtasks Convertible to Training Objective Action Elements N. Task Analysis Information Sheets P 1. Training Objectives Arranged/Combined for Testing Purposes
F. Tasks for OJT, Extension Courses and Other Means (P 23)	D. Completed Matrix Form Task Inventory D 1. Subtasks Purged From Matrix Form Task Inventory G. Job Task Data Cards	
G 1. Tasks Convertible to Training Objective Action Elements (P 25)	E. Tasks Identified for School Training	G 3. Tasks and Subtasks Recorded on JTDC's
G 2. Subtasks Convertible to Training Objective Action Elements (P 25)	D 1. Subtasks Purged From Matrix Form Task Inventory E. Tasks Identified for School Training	G 3. Tasks and Subtasks Recorded on JTDC's
G 3. Tasks and Subtasks Recorded on JTDC's (P 27)	G 1. Tasks Convertible to Training Objective Action Elements G 2. Subtasks Convertible to Training Objective Action Elements	G 4. Job Conditions for Each Task and Subtask G 6. Job Standards: Published, Derived or Implied G 7. Skills and Knowledges for Each Task and Subtask H 2. Training Action Element for Each Task and Subtask
G 4. Job Conditions for Each Task and Subtask (P 27)	A 6. Major Job Requirements A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing A 10. Information Sources G 3. Tasks and Subtasks Recorded on JTDC's	G 5. Standardized Job Conditions for Tasks and Subtasks
G 5. Standardized Job Conditions for Tasks and Subtasks (P 28)	G 4. Job Conditions for Each Task and Subtask	H 3. Training Condition Element for Each Task and Subtask
G 6. Job Standards: Published, Derived, or Implied (P 28)	A 10. Information Sources G 3. Tasks and Subtasks Recorded on JTDC's	H 4. Training Standard Element for Each Task and Subtask
G 7. Skills and Knowledges for Each Task and Subtask (P 29)	G 3. Tasks and Subtasks Recorded on JTDC's	G 8. Standardized List of Skills and Knowledges
G 8. Standardized List of Skills and Knowledges (P 30)	G 7. Skills and Knowledges for Each Task and Subtask	G 9. Skills and Knowledges Requiring School Training
G 9. Skills and Knowledges Requiring School Training (P 30)	G 8. Standardized List of Skills and Knowledges	G 10. Attitudes, Job Conditions and Standards for Skills and Knowledges Requiring School Training H 5. Training Action Element for Each Skill and Knowledge
G 10. Attitudes, Job Conditions, and Job Standards for Skills and Knowledges Requiring School Training (P 30)	A 6. Major Job Requirements A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing A 10. Information Sources G 9. Skills and Knowledges Requiring School Training	G 12. Attitudes Requiring School Training H 6. Training Condition Element for Each Skill and Knowledge H 7. Training Standard Element for Each Skill and Knowledge
G 11. Attitudes for Each Task and Subtask (P 30)	A 6. Major Job Requirements A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing A 10. Information Sources	G 12. Attitudes Requiring School Training
G 12. Attitudes Requiring School Training (P 30&34, Implied)	G 10. Attitudes, Job Conditions and Standards for Skills and Knowledges Requiring School Training G 11. Attitudes for Each Task and Subtask	H 8. Training Action Element for Each Attitude
G. Job Task Data Cards (JTDC) (P 24)	C 3. Action-Object Relationships and Qualifiers Needed	F. Tasks for OJT, Extension Courses, and Other Means

Product and Sub-Product	Inputs	Outputs
H 1. File Number, Course ID, and Date (P 31)	A 1. Job Title	Not Identified
H 2. Training Action Element for Each Task and Subtask (P 32)	G 3. Tasks and Subtasks Recorded on JTDC's	H 11. Training Criterion for Each Training Objective
H 3. Training Condition Element for Each Task and Subtask (P 32)	G 5. Standardized Job Conditions for Tasks and Subtasks	I 1. Clustered TAIS's Q 2. Job Conditions and Standards for Each Training Objective Altered for Testing Purposes
H 4. Training Standard Element for Each Task and Subtask (P 32)	A 6. Major Job Requirements G 6. Job Standards: Published, Derived or Implied	Q 2. Job Conditions and Standards for Each Training Objective Altered for Testing Purposes
H 5. Training Action Element for Each Skill and Knowledge (P 30&32)	G 9. Skills and Knowledges Requiring School Training	I 1. Clustered TAIS's
H 6. Training Condition Element for Each Skill and Knowledge (P 30&32, Implied)	G 10. Attitudes, Job Conditions and Standards for Skills and Knowledges Requiring School Training	Q 2. Job Conditions and Standards for Each Training Objective Altered for Testing Purposes
H 7. Training Standard Element for Each Skill and Knowledge (P 34)	G 10. Attitudes, Job Conditions and Standards for Skills and Knowledges Requiring School Training	Q 2. Job Conditions and Standards for Each Training Objective Altered for Testing Purposes
H 8. Training Action Element for Each Attitude (P 34, Implied)	G 12. Attitudes Requiring School Training	I 1. Clustered TAIS's
H 9. Training Condition Element for Each Attitude (P 34, Implied)	A 6. Major Job Requirements A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing A 10. Information Sources	Q 2. Job Conditions and Standards for Each Training Objective Altered for Testing Purposes
H 10. Training Standard Element for Each Attitude (P 34, Implied)	A 10. Information Sources	H 11. Training Criterion for Each Training Objective Q 2. Job Conditions and Standards for Each Training Objective Altered for Testing Purposes
H 11. Training Criterion for Each Training Objective (P 34)	H 2. Training Action Element for Each Task and Subtask H 10. Training Standard Element for Each Attitude	Not Identified
I. Task Analysis Information Sheets (TAIS) (P 30)	E. Tasks Identified for School Training	R 1. General Test Design R 5. Faculty Produced Record of Performance
I 1. Clustered TAIS's (P 35)	H 3. Training Condition Element for Each Task and Subtask H 5. Training Action Element for Each Skill and Knowledge H 8. Training Action Element for Each Attitude	I 2. TAIS's Sequenced Within Clusters
I 2. TAIS's Sequenced Within Clusters (P 36)	I 1. Clustered TAIS's	I 3. TAIS Clusters Sequenced J 1. Training Objectives Listed Within Each Cluster
I 3. TAIS Clusters Sequenced (P 37)	I 2. TAIS's Sequenced Within Clusters	J. Evaluation Planning Information Sheets (EPIS)
I. Course Sequenced TAIS's (P 35)		K 1. List Teaching Points for Each Training Objective P. Test Outline P 1. Training Objectives Arranged/Combined for Testing Purposes
J 1. Training Objectives Listed Within Each Cluster (P 43)	I 2. TAIS's Sequenced Within Clusters	J 2. List Clusters With Training Objectives That May be Examined as a Unit J 3. List Clusters with Training Objectives That Form Logical Groups for Separate Examination K 1. List Teaching Points for Each Teaching Objective K 6. List Method of Instruction for Each Teaching Point
J 2. List Clusters with Training Objectives that may be Examined as a Unit (P 44)	J 1. Training Objectives Listed Within Each Cluster	J 3. List Clusters with Training Objectives that Form Logical Groups for Separate Examination

Product and Sub-Product	Inputs	Outputs
J 3. List of Clusters with Training Objectives that Form Logical Groups for Separate Examination (P 44)	J 1. Training Objectives Listed Within Each Cluster J 2. List Clusters with Training Objectives that may be Examined as a Unit	Not Identified
J. Evaluation Planning Information Sheets (EPIS) (P 43)	I 3. TAIS Clusters Sequenced	P 1. Training Objectives Arranged/Combined for Testing Purposes
K 1. List of Teaching Points for Each Training Objective (P 46)	I. Course Sequenced TAIS's J 1. Training Objectives Listed Within Each Cluster	K 2. List Subordinate Teaching Points for Any Teaching Point K 3. Sequence Teaching Points Within Training Objectives for Effective Learning K 11. List Estimated Time for Each Training Objective L 2. Design Each Lesson
K 2. List Subordinate Teaching Points for Any Teaching Point (P 46)	K 1. List Teaching Points for Each Training Objective	K 3. Sequence Teaching Points Within Training Objectives for Effective Learning
K 3. Sequence Teaching Points Within Training Objectives for Effective Learning (P 46)	K 1. List Teaching Points for Each Training Objective K 2. List Subordinate Teaching Points for Any Teaching Point	K 4. List References for Each Teaching Point K 6. List Method of Instruction for Each Teaching Point
K 4. List References for Each Teaching Point (P 46)	A 6. Major Job Requirement A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing A 10. Information Sources K 3. Sequence Teaching Points Within Training Objectives for Effective Learning	K 5. Standardized List of References M 1. Select Training Literature for Lesson Content and Each Training Objective M 2. Design Method for Teaching Student to Use Training Literature
K 5. Standardized List of References (P 46)	K 4. List References for Each Teaching Point	Not Identified
K 6. List Method of Instruction for Each Teaching Point (P 46)	A 6. Major Job Requirements A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing A 10. Information Sources J 1. Training Objectives Listed Within Each Cluster K 3. Sequence Teaching Points Within Training Objectives for Effective Learning	K 7. List Media and Aids for Each Teaching Point K 8. List Training Equipment and Facilities for Each Teaching Point K 9. Revise Methods of Instruction by Tradeoffs Between Best Possible and Available Media and Aids, Training Equipment and Facilities K 10. List Estimated Time for Each Teaching Point
K 7. List of Media and Aids for Each Teaching Point (P 47)	A 6. Major Job Requirements A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing A 10. Information Sources K 6. List Method of Instruction for Each Teaching Point	K 8. List Training Equipment and Facilities for Each Teaching Point K 9. Revise Methods of Instruction by Tradeoffs Between Best Possible and Available Media and Aids, Training Equipment and Facilities K 10. List Estimated Time for Each Teaching Point R 6. Test Administration
K 8. List of Training Equipment and Facilities for Each Teaching Point (P 48)	K 6. List Method of Instruction for Each Teaching Point K 7. List Media and Aids for Each Teaching Point	K 9. Revise Methods of Instruction by Tradeoffs Between Best Possible and Available Media and Aids, Training Equipment and Facilities K 10. List Estimated Time for Each Teaching Point R 6. Test Administration
K 9. Revise Methods of Instruction by Tradeoffs Between Best Possible and Available Media and Aids, Training Equipment and Facilities (P 49)	K 6. List Method of Instruction for Each Teaching Point K 7. List Media and Aids for Each Teaching Point K 8. List Training Equipment and Facilities for Each Teaching Point	Not Identified
K 10. List Estimated Time for Each Teaching Point (P 49)	K 6. List Method of Instruction for Each Teaching Point K 7. List Media and Aids for Each Teaching Point K 8. List Training Equipment and Facilities for Each Teaching Point	K 11. List Estimated Time for Each Training Objective L 2. Design Each Lesson
K 11. List Estimated Time for Each Training Objective (P 49)	K 1. List Teaching Points for Each Training Objective K 10. List Estimated Time for Each Teaching Point	L 2. Design Each Lesson

Product and Sub-Product	Inputs	Outputs
K. TAIS: Learning Analysis (P 45)		L 1. Identify and List Each Lesson N. Program of Instruction O. Training Schedule P 1. Training Objectives Arranged/Combined for Testing Purposes P 2. List Possible Versions of Each Training Objective Q 1. Each Version of Each Training Objective Altered for Testing, if Necessary Q 2. Job Conditions and Standards for Each Training Objective Altered for Testing Purposes R 1. General Test Design R 5. Faculty Produced Record of Performance
L 1. Identify and List Each Lesson (P 49)	K. TAIS: Learning Analysis	L 2. Design Each Lesson
L 2. Design Each Lesson (P 49)	A 10. Information Sources K 1. List Teaching Points for Each Training Objective K 10. List Estimated Time for Each Teaching Point K 11. List Estimated Time for Each Training Objective L 1. Identify and List Each Lesson L 3. Continuously Revise Lessons With Results of New Technology and Training Quality Control	L 3. Continuously Revise Lessons With Results of New Technology and Training Quality Control
L 3. Continuously Revise Lessons With Results of New Technology and Training Quality Control (P 50)	A 10. Information Sources L 2. Design Each Lesson S. Training Quality Control	L 2. Design Each Lesson
L. Lesson Plan (P 49)		O. Training Schedule P 1. Training Objectives Arranged/Combined for Testing Purposes P 2. List Possible Versions of Each Training Objective
M 1. Select Training Literature for Lesson Content and Each Training Objective (P 50)	K 4. List References for Each Teaching Point	Not Identified
M 2. Design Method for Teaching Students to Use Training Literature (P 51, Implied)	A 10. Information Sources K 4. List References for Each Teaching Point	Not Identified
M. Training Literature (P 50)		
N. Program of Instruction (POI) (P 51)	A 10. Information Sources K. TAIS: Learning Analysis	
O. Training Schedule (P 51)	A 10. Information Sources K. TAIS: Learning Analysis L. Lesson Plan	
P 1. Training Objectives Arranged/Combined for Testing Purposes (P 54)	E. Tasks Identified for School Training I. Course Sequenced TAIS's J. Evaluation Planning Information Sheets (EPIS) K. TAIS: Learning Analysis L. Lesson Plan	P 2. List Possible Versions of Each Training Objective R 1. General Test Design R 2. Design Test Problems
P 2. List Possible Versions of Each Training Objective (P 55)	A 6. Major Job Requirements A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing A 10. Information Sources K. TAIS: Learning Analysis L. Lesson Plan P 1. Training Objectives Arranged/Combined for Testing Purposes	P 3. Sampling Plan for Testing Versions of Each Training Objective Q 1. Each Version of Each Training Objective Altered for Testing, if Necessary R 3. Design Answer Sheet
P 3. Sampling Plan for Testing Versions of Each Training Objective (P 56)	P 2. List Possible Versions of Each Training Objective	Not Identified
P. Test Outline (P 54)	I. Course Sequenced TAIS's	
Q 1. Each Version of Each Training Objective Altered for Testing Purposes, if Necessary (P 61)	K. TAIS: Learning Analysis P 2. List Possible Versions of Each Training Objective	Q 2. Job Conditions and Standards for Each Training Objective Altered for Testing Purposes S 4. Interpreting Test Instrument Deficiencies

Product and Sub-Product	Inputs	Outputs
Q 2. Job Conditions and Standards for Each Training Objective Altered for Testing Purposes (P 61)	H 3. Training Condition Element for Each Task and Subtask H 4. Training Standard Element for Each Task and Subtask H 6. Training Condition Element for Each Skill and Knowledge H 7. Training Standard Element for Each Skill and Knowledge H 9. Training Condition Element for Each Attitude H 10. Training Standard Element for Each Attitude K. TAIS: Learning Analysis Q 1. Each Version of Each Training Objective Altered for Testing, if Necessary	S 4. Interpreting Test Instrument Deficiencies S 5. Interpreting Student Performance
Q. Minimum Test Standards for Each Training Objective (P 60)		
R 1. General Test Design (P 65)	A 6. Major Job Requirements A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing A 10. Information Sources D 1. Subtasks Purged From Matrix Form Task Inventory H. Task Analysis Information Sheet (TAIS) K. TAIS: Learning Analysis P 1. Training Objectives Arranged/Combined for Testing Purposes	R 6. Test Administration R 7. Directions for Scoring
R 2. Design Test Programs (P 65)	A 6. Major Job Requirements A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing A 10. Information Sources P 1. Training Objectives Arranged/Combined for Testing Purposes	R 4. Test Instrument Review R 6. Test Administration R 8. Test Validation S 4. Interpreting Test Instrument Deficiencies S 6. Test Results Report
R 3. Design Answer Sheet (P 65)	A 6. Major Job Requirements A 7. Work Environment A 8. Supervision and Assistance Available A 9. Equipment Listing A 10. Information Sources P 2. List Possible Versions of Each Training Objective	R 4. Test Instrument Review R 6. Test Administration R 7. Directions for Scoring
R 4. Test Instrument Review (P 66)	R 2. Design Test Problems R 3. Design Answer Sheet	Not Identified
R 5. Faculty Produced Record of Performance (P 66)	H. Task Analysis Information Sheets (TAIS) K. TAIS: Learning Analysis	R 7. Directions for Scoring S 4. Interpreting Test Instrument Deficiencies
R 6. Test Administration (P 67)	K 7. List Media and Aids for Each Teaching Point K 8. List Training Equipment and Facilities for Each Teaching Point R 1. General Test Design R 2. Design Test Problems R 3. Design Answer Sheet	S 4. Interpreting Test Instrument Deficiencies
R 7. Directions for Scoring (P 68)	A 10 Information Sources R 1. General Test Design R 3. Design Answer Sheet R 5. Faculty Produced Record of Performance	Not Identified
R 8. Test Validation (P 68)	A 10. Information Sources R 2. Design Test Problems	S 4. Interpreting Test Instrument Deficiencies
R. Test Instruments (P 64)		
S 1. Percent of Students Achieving Minimum Standard (P 73)	A 10. Information Sources	Not Identified
S 2. Analysis of Performance Errors (P 73)	A 10. Information Sources	Not Identified

Product and Sub-Product	Inputs	Outputs
S 3. Average Student Performance (P 74)	A 10. Information Sources	S 5. Interpreting Student Performance S 6. Test Results Report S 7. Monitoring Training Quality and Adjusting Training Program
S 4. Interpreting Test Instrument Deficiencies (P 75)	Q 1. Each Version of Each Training Objective Altered for Testing, if Necessary Q 2. Job Conditions and Standards for Each Training Objective Altered for Testing Purposes R 2. Design Test Problems R 5. Faculty Produced Record of Performance R 6. Test Administration R 8. Test Validation	S 6. Test Results Report
S 5. Interpreting Student Performance (P 76)	A 10. Information Sources Q 2. Job Conditions and Standards for Each Training Objective Altered for Testing Purposes S 3. Average Student Performance	Not Identified
S 6. Test Results Report (P 76)	A 10. Information Sources R 2. Design Test Problems S 3. Average Student Performance S 4. Interpreting Test Instrument Deficiencies	S 7. Monitoring Training Quality and Adjusting Training Program
S 7. Monitoring Training Quality and Adjusting Training Program (P 77)	S 3. Average Student Performance S 6. Test Results Report	Not Identified
S. Training Quality Control (P 70)		L 3. Continuously Revise Lessons With Results of New Technology and Training Quality Control

Appendix G

INPUT/OUTPUT MATRIX FORM ANALYSIS

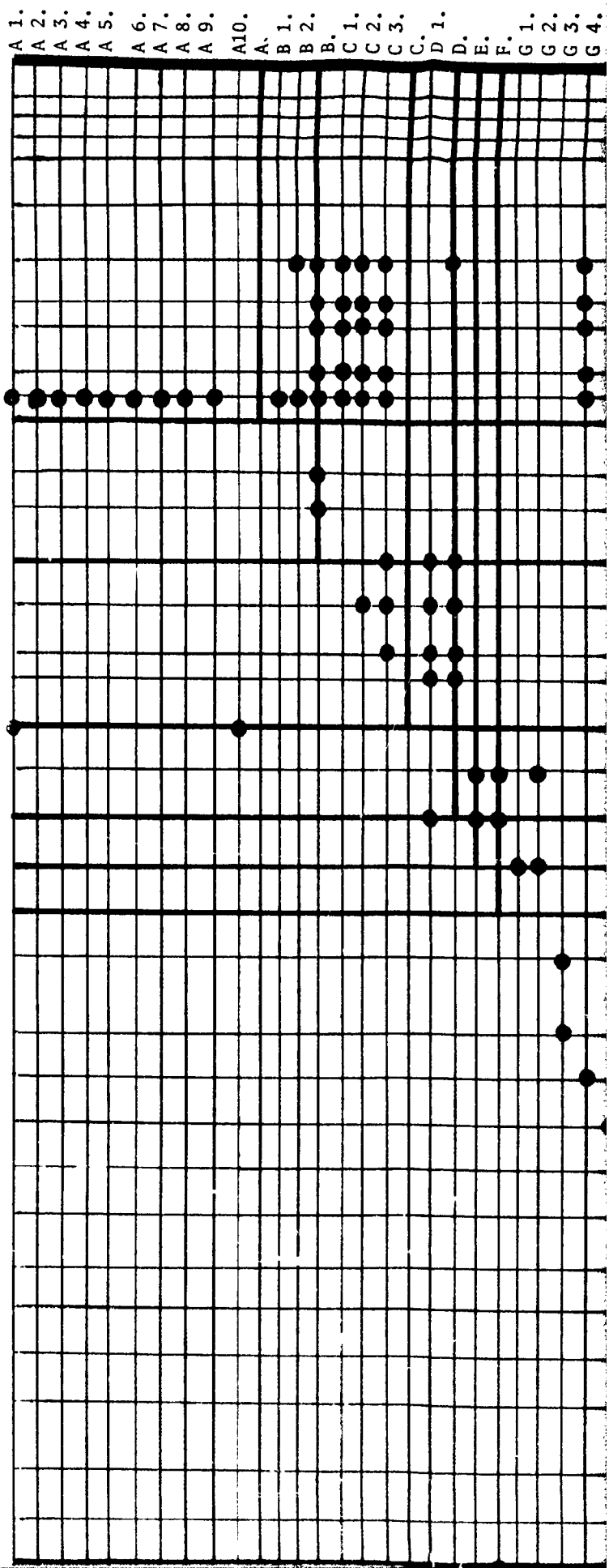
This appendix presents results of the third step taken in detailed analysis of USCONARC Regulation 350-100-1. Since a full awareness of the inputs/outputs for each product/subproduct (Appendix F) was determined crucial for optimal systems engineering of training, these inputs/outputs were organized into matrix form. This matrix was found useful in obtaining a global view of the input/output flow process detailed in Appendix F and in gaining a clear awareness of the "downstream" impact and uses made of each product/subproduct.

In the matrix, input information requirements are determined by going from the horizontal axis, through the dots, to the vertical axis, and output information requirements are determined by going from the vertical axis, through the dots, to the horizontal axis. Input information, required by a product/subproduct listed on the upper horizontal axis, is indicated by the dots directly under it. Output information requirements, for a product/subproduct listed on the left vertical axis, are indicated by dots directly to its right. For example, the required inputs for subproduct G 4. are determined by tracing down from G 4. to the first dot which corresponds to subproduct A 6., then to the second dot (A 7.), the third (A 8.), the fourth (A 9.), and the fifth (A 10.). The output required for subproduct G 4. is determined by locating G 4. on the vertical axis and tracing horizontally from left to right to this first dot, which indicates subproduct G 5. as the only output for G 4.

Since this matrix provides such an instant global view of each product/subproduct's information requirements, it is suggested that a matrix of this type be considered for inclusion in any revision to USCONARC Regulation 350-100-1.

PRODUCTS

A 1. JOB TITLE (P 9)
A 2. MOS JOB STRUCTURE (P 9)
A 3. DUTY POSITION (P 9)
A 4. UNITS & ORGANIZATIONS ASSIGNED (P 9)
A 5. RELATED UNITS, ORGANIZATIONS & MOS (P 9)
A 6. MAJOR JOB REQUIREMENTS (P 9)
A 7. WORK ENVIRONMENT (P 9)
A 8. SUPERVISION & ASSISTANCE AVAILABLE (P 10)
A 9. EQUIPMENT LISTING (P 10)
A10. INFORMATION SOURCES (P 10)
A. JOB ANALYSIS: IDENTIFICATION OF THE JOB (P 8)
B 1. LIST OF MAJOR DUTY AREAS (P 15)
B 2. STATEMENTS OF TASKS PERFORMED (P 15)
B. JOB ANALYSIS: TASK INVENTORY/ OUTLINE FORM (P 15)
C 1. LIST OF TANGIBLE OBJECTS (P 16)
C 2. LIST OF ACTION VERBS (P 17)
C 3. ACTION-OBJECT RELATIONSHIPS & QUALIFIERS NEEDED (P 19)
C. JOB ANALYSIS: TASK INVENTORY/ MATRIX FORM (P 16)
D 1. SUBTASKS PURGED FROM MATRIX FORM TASK INVENTORY (P 20)
D. COMPLETED MATRIX FORM TASK INVENTORY (P 20)
E. TASKS IDENTIFIED FOR SCHOOL TRAINING (P 21)
F. TASKS FOR OJT, EXTENSION COURSES, & OTHER MEANS (P 23)
G 1. TASKS CONVERTIBLE TO TRAINING OBJECTIVE ACTION ELEMENTS (P 25)
G 2. SUBTASKS CONVERTIBLE TO TRAINING OBJECTIVE ACTION ELEMENTS (P 25)
G 3. TASKS & SUBTASKS RECORDED ON JTDC's (P 27)
G 4. JOB CONDITIONS FOR EACH TASK AND SUBTASK (P 27)
G 5. STANDARDIZED JOB CONDITIONS FOR TASKS & SUBTASKS (P 28)
G 6. JOB STANDARDS: PUBLISHED, DERIVED OR IMPLIED (P 28)
G 7. SKILLS & KNOWLEDGES FOR EACH TASK & SUBTASK (P 29)
G 8. STANDARDIZED LIST OF SKILLS & KNOWLEDGES (P 30)
G 9. SKILLS & KNOWLEDGES REQUIRING SCHOOL TRAINING (P 30)
G10. ATTITUDES, JOB CONDITIONS & STANDARDS FOR SKILLS & KNOWLEDGES REQUIRING SCHOOL TRAINING (P 30)
G11. ATTITUDES FOR EACH TASK & SUBTASK (P 30)
G12. ATTITUDES REQUIRING SCHOOL TRAINING (P 30 & 34 IMPLIED)
G. JOB TASK DATA CARDS



AND SUBPRODUCTS DOTS INDICATE REQUIRED INPUTS

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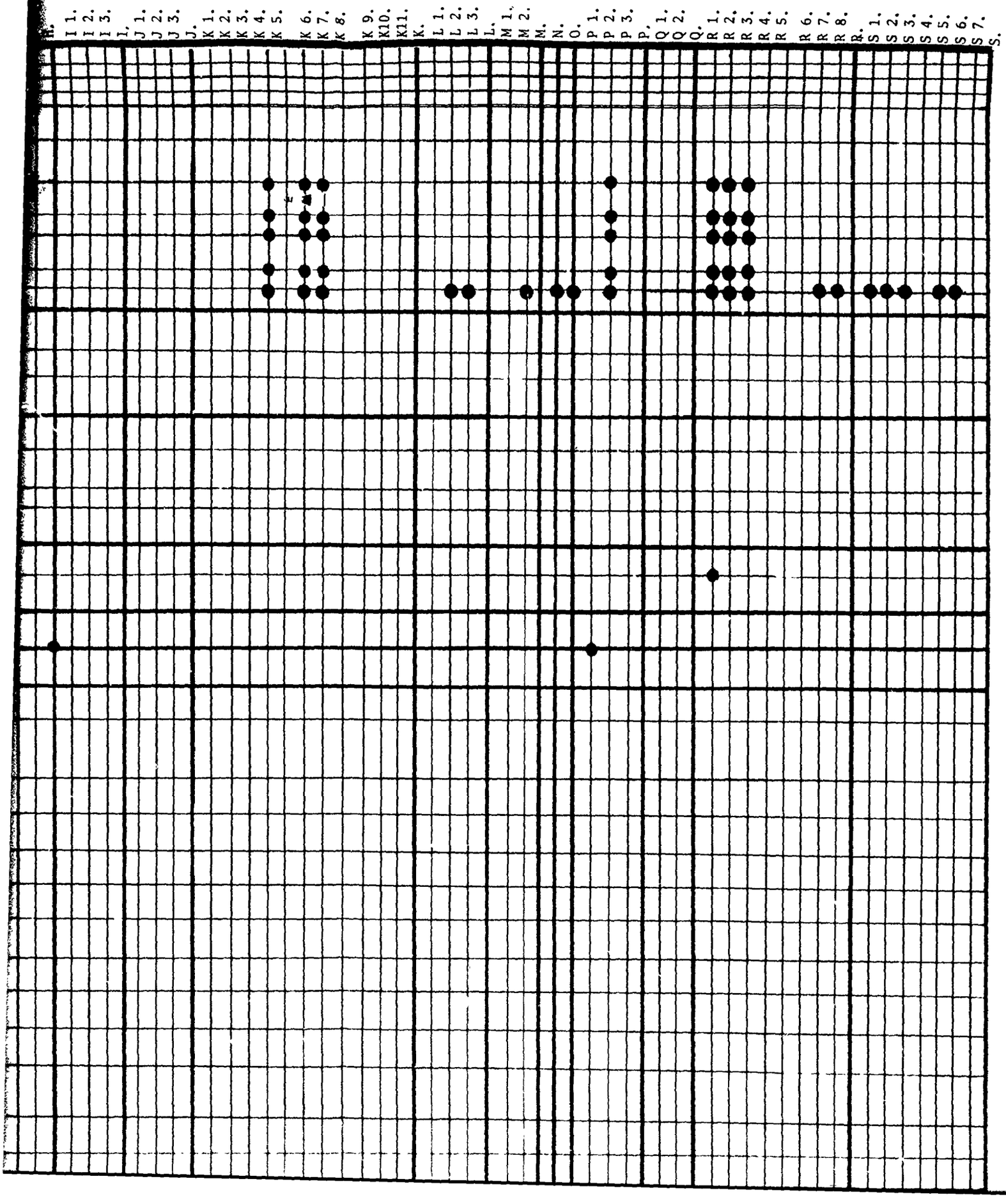
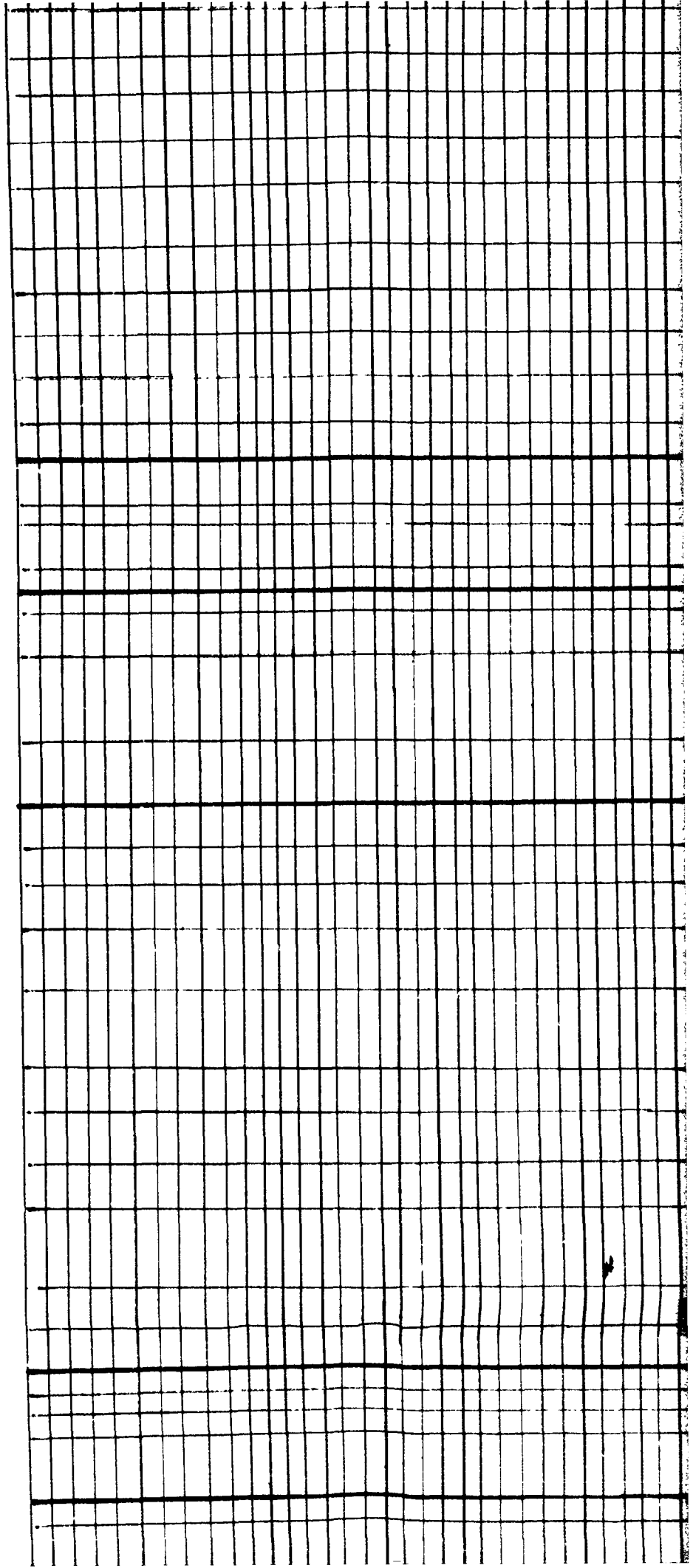
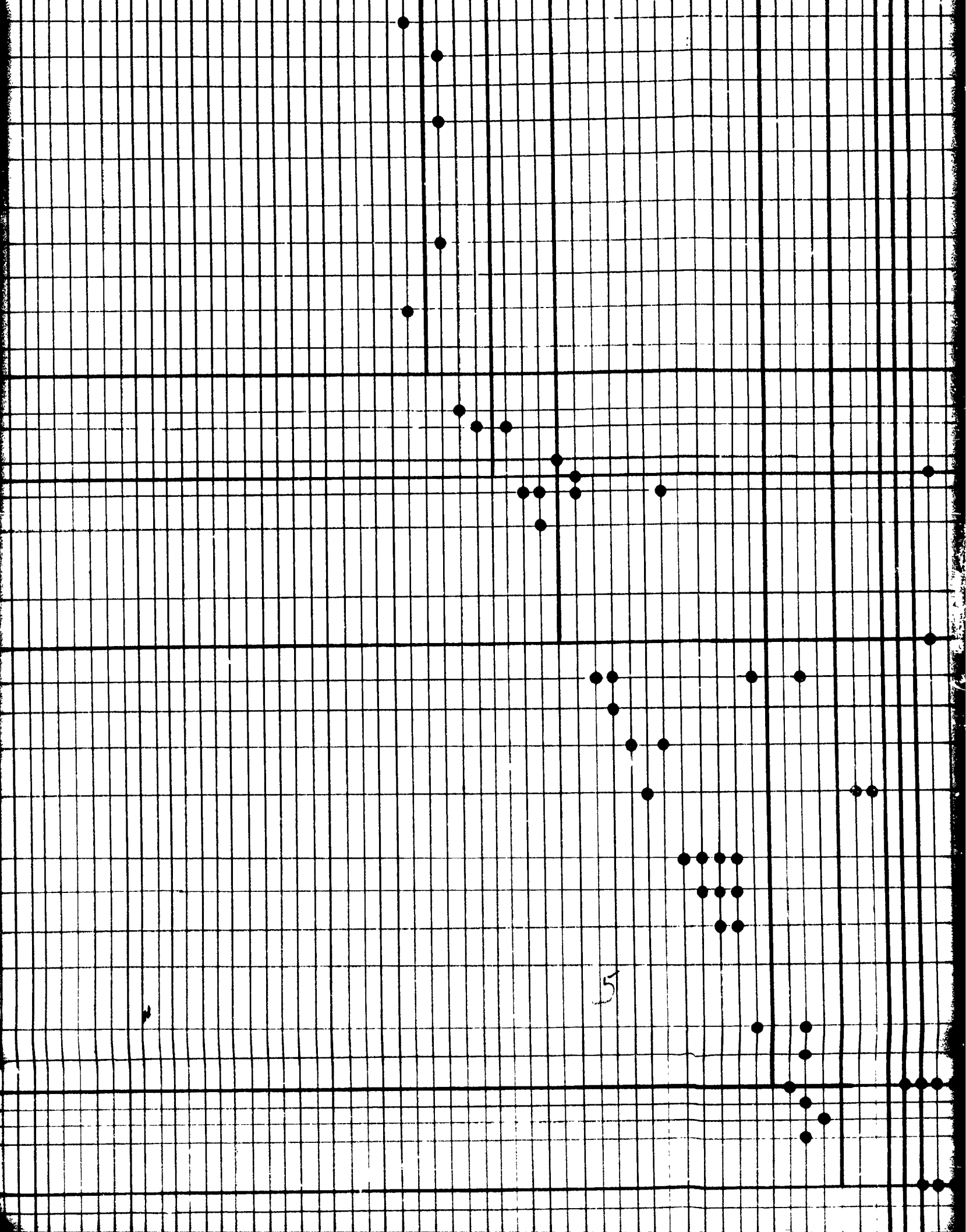
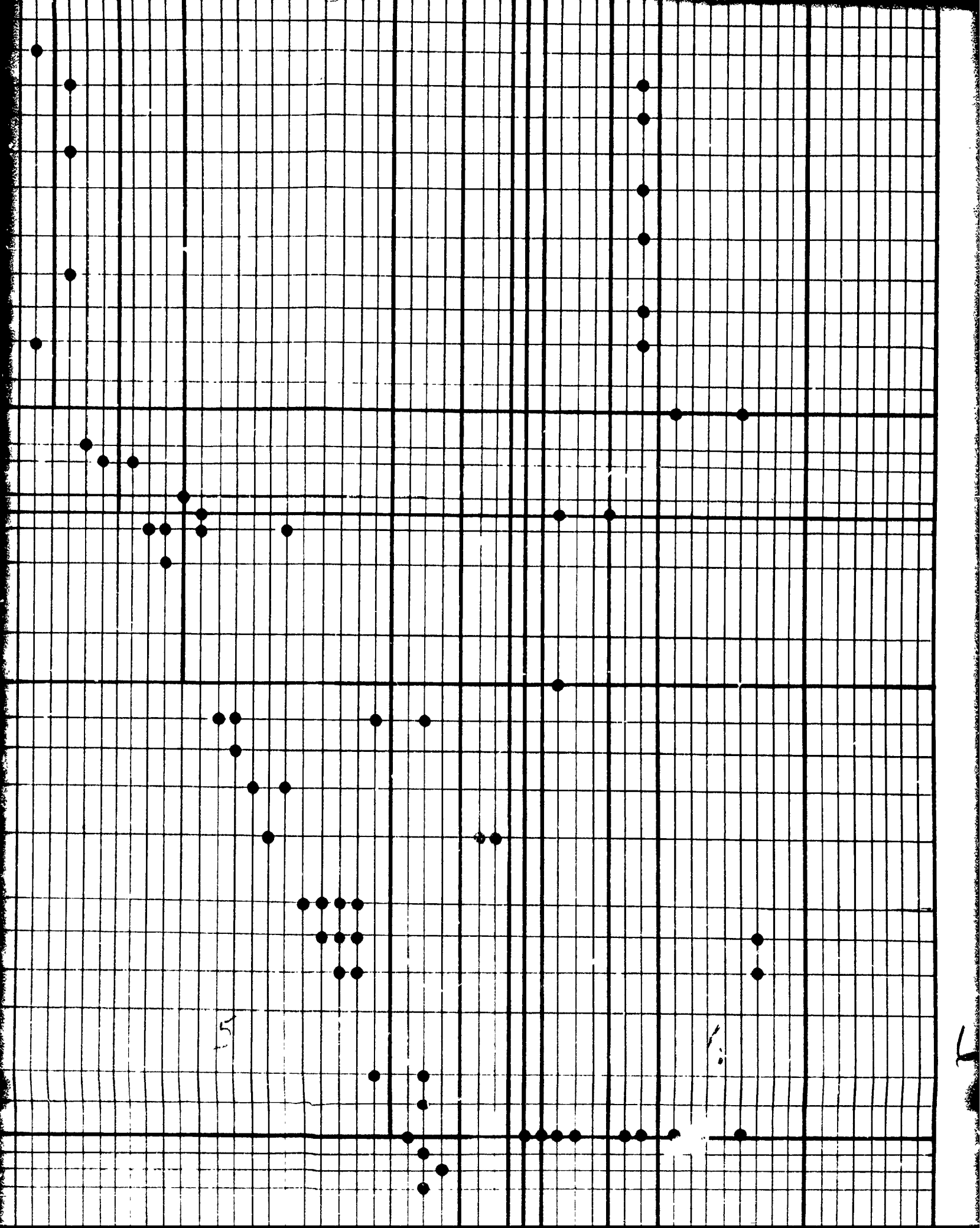


PRODUCTS AND SUBPRODUCTS DOTS INDICATE REQUIRED OUTPUTS

H 2. TRAINING ACTION ELEMENT FOR EACH TASK & SUBTASK (P 32)
H 3. TRAINING CONDITION ELEMENT FOR EACH TASK & SUBTASK (P 32)
H 4. TRAINING STANDARD ELEMENT FOR EACH TASK & SUBTASK (P 32)
H 5. TRAINING ACTION ELEMENT FOR EACH SKILL & KNOWLEDGE (P 30&32)
H 6. TRAINING CONDITION ELEMENT FOR EACH SKILL & KNOWLEDGE (P 30 & 32 IMPLIED)
H 7. TRAINING STANDARD ELEMENT FOR EACH SKILL & KNOWLEDGE (P 34)
H 8. TRAINING ACTION ELEMENT FOR EACH ATTITUDE (P 34 IMPLIED)
H 9. TRAINING CONDITION ELEMENT FOR EACH ATTITUDE (P 34 IMPLIED)
H10. TRAINING STANDARD ELEMENT FOR EACH ATTITUDE (P 34 IMPLIED)
H11. TRAINING CRITERION FOR EACH TRAINING OBJECTIVE (P 34)
H. TASKS ANALYSIS INFORMATION SHEETS (TAIS) (P 30)
I 1. CLUSTERED TAIS's (P 35)
I 2. TAIS's SEQUENCED WITHIN CLUSTERS (P 36)
I 3. TAIS CLUSTERS SEQUENCED (P 37)
I. COURSE SEQUENCED TAIS's (P 35)
J 1. TRAINING OBJECTIVES LISTED WITHIN EACH CLUSTER (P 43)
J 2. LIST CLUSTERS WITH TRAINING OBJECTIVES THAT MAY BE EXAMINED AS A UNIT (P 44)
J 3. LIST CLUSTERS WITH TRAINING OBJECTIVES THAT FORM LOGICAL GROUPS FOR SEPARATE EXAMINATION (P 44)
J. EVALUATION PLANNING INFORMATION SHEETS (EPIS) (P 43)
K 1. LIST TEACHING POINTS FOR EACH TRAINING OBJECTIVE (P 46)
K 2. LIST SUBORDINATE TEACHING POINTS FOR ANY TEACHING POINT (P 46)
K 3. SEQUENCE TEACHING POINTS WITHIN TRAINING OBJECTIVES FOR EFFECTIVE LEARNING (P 46)
K 4. LIST REFERENCES FOR EA. TEACHING POINT (P 46)
K 5. STANDARDIZED LIST OF REFERENCES (P 46)
K 6. LIST METHOD OF INSTRUCTION FOR EA. TEACHING POINT (P 46)
K 7. LIST MEDIA & AIDS FOR EA. TEACHING POINT (P 47)
K 8. LIST TRAINING EQUIPMENT & FACILITIES FOR EACH TEACHING POINT (P 48)
K 9. REVISE METHODS OF INSTRN. BY TRADE-OFFS BETWEEN BEST POSSIBLE & AVAIL. MEDIA & AIDS, TRNG. EQUIP. & FACILITIES (P 49)
K10. LIST ESTIMATED TIME FOR EACH TEACHING POINT (P 49)
K11. LIST ESTIMATED TIME FOR EACH TRAINING OBJECTIVE (P 49)
K. TAIS: LEARNING ANALYSIS (P 45)
L 1. IDENTIFY & LIST EA. LESSON (P 49)
L 2. DESIGN EACH LESSON (P 49)
L 3. CONTINUOUSLY REVISE LESSONS WITH RESULTS OF NEW TECH. & TRNG. QUAL. CONTROL (P 50)
L. LESSON PLAN (P 49)
M 1. SELECT TRNG. LITERATURE FOR LESSON CONTENT & EACH TRAIN-







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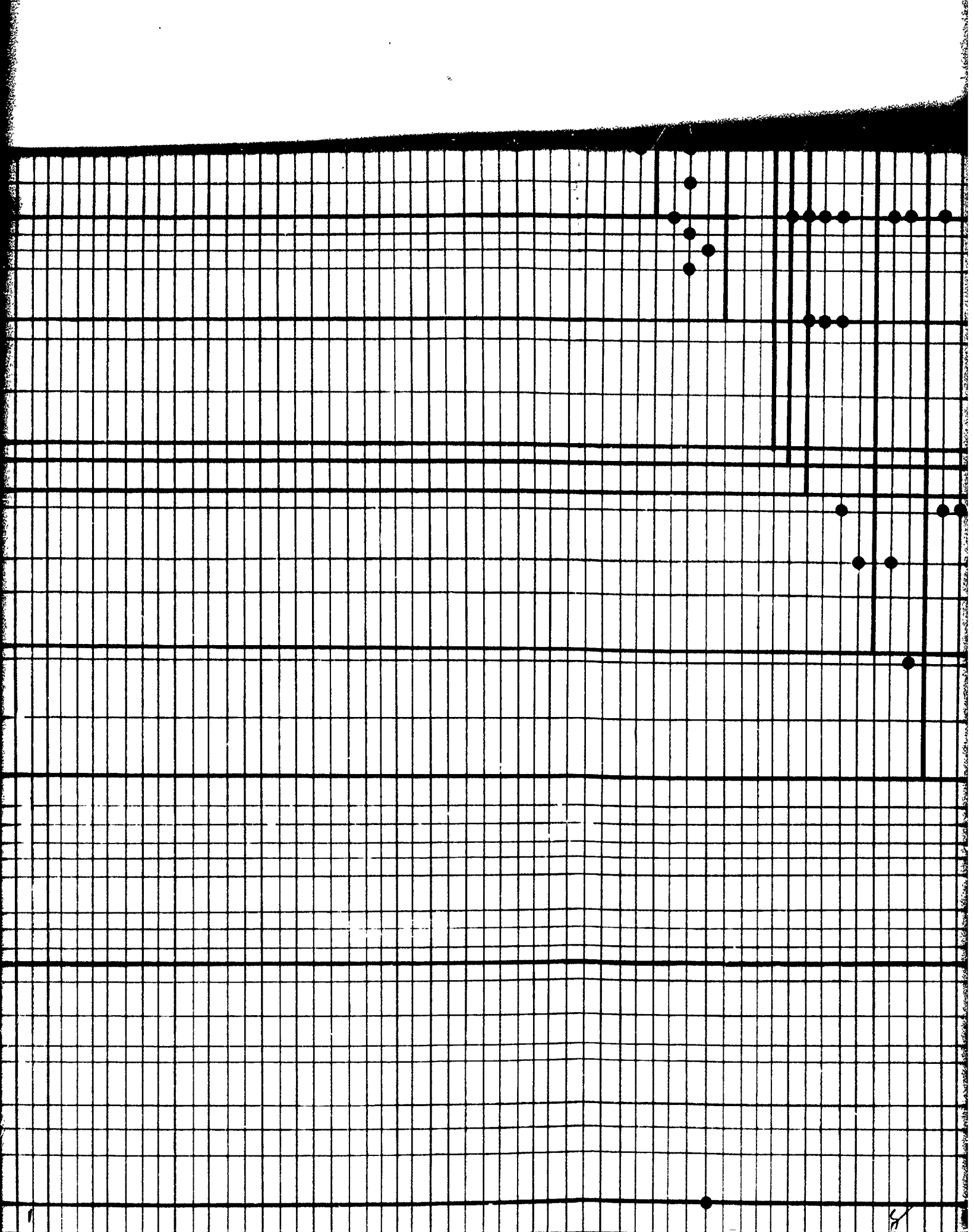
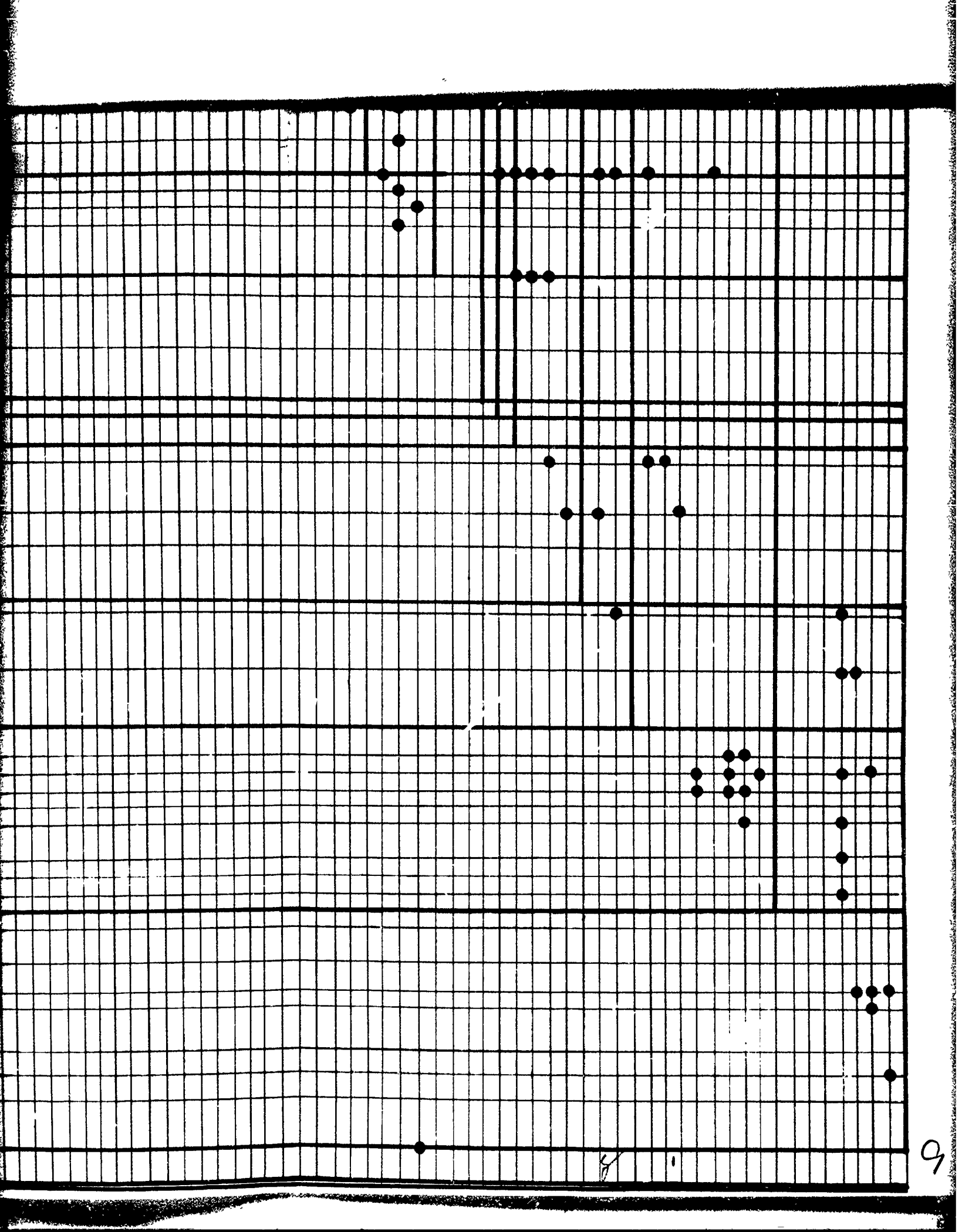
K11. LIST ESTIMATED TIME FOR EACH TRAINING OBJECTIVE (P 49)
K. TAIS: LEARNING ANALYSIS (P 45)
L 1. IDENTIFY & LIST EA. LESSON (P 49)
L 2. DESIGN EACH LESSON (P 49)
L 3. CONTINUOUSLY REVISE LESSONS WITH RESULTS OF NEW TECH. & TRNG. QUAL. CONTROL (P 50)
L. LESSON PLAN (P 49)
M 1. SELECT TRNG. LITERATURE FOR LESSON CONTENT & EACH TRAINING OBJECTIVE (P 50)
M 2. DESIGN METHOD FOR TEACHING STUDENT TO USE TRAINING LITERATURE (P 50 IMPLIED)
M. TRAINING LITERATURE (P 50)
N. PROGRAM OF INSTRUCTION (POI) (P 51)
O. TRAINING SCHEDULE (P 51)
P 1. TRAINING OBJECTIVES ARRANGED/ COMBINED FOR TESTING PURPOSES (P 54)
P 2. LIST POSSIBLE VERSIONS OF EA. OBJECTIVE (P 56)
P 3. SAMPLING PLAN FOR TESTING VERSIONS OF EA. TRAINING OBJECTIVE (P 56)
P. TEST OUTLINE (P 54)
Q 1. EA. VERSION OF EA. TRNG. OBJECTIVE ALTERED FOR TESTING, IF NECESSARY (P 61)
Q 2. JOB CONDITIONS & STANDARDS FOR EA. TRNG. OBJECTIVE ALTERED FOR TESTING PURPOSES (P 61)
Q. MINIMUM TEST STANDARDS FOR EA. TRNG. OBJECTIVE (P 60)
R 1. GENERAL TEST DESIGN (P 65)
R 2. DESIGN TEST PROBLEMS (P 65)
R 3. DESIGN ANSWER SHEET (P 65)
R 4. TEST INSTRUMENT REVIEW (P 66)
R 5. FACULTY PRODUCED RECORD OF PERFORMANCE (P 66)
R 6. TEST ADMINISTRATION (P 67)
R 7. DIRECTIONS FOR SCORING (P 68)
R 8. TEST VALIDATION (P 68)
R. TEST INSTRUMENTS (P 64)
S 1. PERCENT OF STUDENTS ACHIEVING MINIMUM STANDARDS (P 73)
S 2. ANALYSIS OF PERFORMANCE ERRORS (P 74)
S 3. AVERAGE STUDENT PERFORMANCE (P 74)
S 4. INTERPRETING TEST INSTRUMENT DEFICIENCIES (P 75)
S 5. INTERPRETING STUDENT PERFORMANCE (P 76)
S 6. TEST RESULTS REPORT (P 76)
S 7. MONITORING TRNG. QUALITY & ADJUSTING TRNG. PROGRAM (P 77)
S. TRAINING QUALITY CONTROL (P 70)





Appendix H

GUIDANCE AND PERSONNEL PROVISIONS MATRIX

This appendix presents results of the fourth step taken in detailed analysis of USCONARC Regulation 350-100-1. To this point, information obtained from interviews and analysis of USCONARC Regulation 350-100-1 indicated a lack of adequate provisions for detailed procedural guidance and personnel expertise requirements. Therefore, each product/subproduct listed in Appendix E was evaluated according to eight content factors, and the results were listed in matrix form. This matrix evaluation of provisions and guidance for each product/subproduct provided the authors a guide in writing most of the analysis-based items in the Results section (Chapter III) related to USCONARC Regulation 350-100-1, and represents the primary summary of detailed analysis of the Regulation. This matrix analysis should be considered as a set of suggestions for use in revising the content and guidance under each product/subproduct in USCONARC Regulation 350-100-1.

PRODUCTS/SUBPRODUCTS (CDN REG 350-100-1 CONTENT EVALUATION FACTORS)	Does CDN REG 350-100-1 Clearly Identify This Product/Subproduct as an Essential Step?	Is Sufficiently Detailed Procedural Guidance Provided?	Are Practical and Specific Working Definitions of Terms Provided?	Are Requirements Other Products/Sub-Products Impose on This Product/Sub-Product Clearly Identified?	Is the Use of Examples Satisfactory?	Are Reference Materials, Job Aids, or Other Information Sources Cited?	CDN REG 350-100-1 Specifies No CDG Personnel Experience Requirements.	Experience Needed to Prepare This Product/Subproduct?	CDN REG 350-100-1 Specifies No CDG Personnel Skills & Knowledges Required	Skills and Knowledges Needed.
A. Job Analysis: Identification of the Job (p. 8).	Yes	No	No	No	Clarify	Need More		Field		Field Tasks
A 1. Job Title (p. 9).	Yes	Yes	Yes	None	Yes	Specify		None		None
A 2. MOS Job Structure (p. 9).	Yes	Yes	Yes	None	No	Need More		None		None
A 3. Duty Position (p. 9).	Yes	Yes	Yes	None	Yes	Sufficient		None		None
A 4. Units and Organizations Assigned (p. 9).	Yes	Yes	Yes	None	No	Sufficient		None		None
A 5. Related Units, Organizations and MOS (p. 9).	Yes	Yes	Yes	None	No	Need More		Field		Field Tasks
A 6. Major Job Requirements (p. 9).	Yes	No	No	No	No	Need More		Field		Field Tasks
A 7. Work Environment (p. 9).	Yes	Yes	Yes	No	No	Need More		Field		Field Tasks
A 8. Supervision and Assistance Available (p. 10).	Yes	No	Yes	No	No	Specify		Field		None
A 9. Equipment Listing (p. 10).	Yes	Yes	Yes	No	No	Sufficient		Field		Field Tasks
A 10. Information Sources (p. 10).	Yes	Yes	Yes	No	Yes	Need More		Field		Field Tasks
B. Job Analysis: Task Inventory/Outline Form (p. 15).	Yes	No	No	No	More Range	Specify		Field		Field Tasks
B 1. List of Major Duty Areas (p. 15).	Yes	No	No	No	Yes	Specify		Field		Field Tasks
B 2. Statements of Tasks Performed (p. 15).	Yes	No	No	No	Yes	Specify		Field		Field Tasks
C. Job Analysis: Task Inventory/Matrix Form (p. 16).	Yes	Yes	No	No	More Range	Sufficient		Field		Field Tasks
C 1. List of Tangible Objects (p. 16).	Yes	Yes	No	No	More Range	Sufficient		Field		Field Tasks
C 2. List of Action Verbs (p. 17)	Yes	Yes	No	No	More Range	Sufficient		Field		Field Tasks
C 3. Action-Object Relationships and Qualifiers Needed (p. 19).	Yes	Yes	No	No	More Range	Specify		Field		Field Tasks
D. Completed Matrix Form Task Inventory (p. 20).	Yes	No	Yes	No	More Range	No		Field		Field Tasks
D 1. Subtasks Purged From Matrix Form Task Inventory (p. 20).	No	No	Yes	No	None Prov[a]	No		Field		Field Tasks
E. Tasks Identified for School Training (p. 21).	Yes	No	Yes	No	None Prov	No		Field, Platform & Flight Instn.		Field Tasks, MOI
F. Tasks for OJT, Extension Courses, & Other Means (p. 23).	No	No	Yes	No	None Prov	No		Field, Platform & Flight Instn.		Field Tasks, MOI

[a] *Prov = Provided.*

PRODUCTS/ SUBPRODUCTS (CON REG 350-100-1 CONTENT EVALUATION FACTORS)		Does CON REG 350-100-1 Clearly Identify This Product/Subproduct as an Essential Step?	Is Sufficiently Detailed Procedural Guidance Provided?	Are Practical and Specific Working Definitions of Terms Provided?	Are Requirements Other Products/Sub-Products Impose on This Product/Sub-Product Clearly Identified?	Is the Use of Examples Satisfactory?	Are Reference Materials, Job Aids, or Other Information Sources Cited?	CON REG 350-100-1 Specifies No CDG Personnel Experience Requirements.	Experience Needed to Prepare This Product/Subproduct?	CON REG 350-100-1 Specifies No CDG Personnel Skills & Knowledges Required	Skills and Knowledges Needed.
G.	Job Task Data Cards (JTDC's)(p. 24).	Yes	No	No	No	More Range	Specify		Field, Flight Instn, Lesson Anal./Planning		Field Tasks
G 1.	Tasks Convertible to Training Objective Action Elements (p. 25).	No	Yes	No	No	More Range	No		Field, Platform & Flight Instn		Field Tasks
G 2.	Subtasks Convertible to Training Objective Action Elements (p. 25).	Yes	Yes	No	No	More Range	No		Field, Platform & Flight Instn, Training Tech.		Field Tasks, MOI
G 3.	Tasks and Subtasks Recorded on JTDC's (p. 27).	No	Yes	Yes	No	Yes	No		None		None
G 4.	Job Conditions for Each Task & Subtask (p. 27).	Yes	Yes	No	Yes	More Range	No		Field		Field Tasks
G 5.	Standardized Job Conditions for Tasks & Subtasks (p. 28).	No	Yes	Yes	Yes	More Range	No		Field		Field Tasks
G 6.	Job Standards: Published, Derived or Implied (p. 28).	Yes	Yes	Yes	No	More Range	Need More		Field, Flight Instn, Training Tech. Applications		Field Tasks
G 7.	Skills and Knowledges for Each Task & Subtask (p. 29).	Yes	Yes	No	No	More Range	No		Field, Flight Instn, Training Tech. Applications		Field Tasks
G 8.	Standardized List of Skills & Knowledges (p. 30).	No	Yes	Yes	Yes	None Prov	No		None		None
G 9.	Skills & Knowledges Requiring School Training (p. 30).	No	No	Yes	Yes	More Range	No		Field, Platform & Flight Instn		Field Tasks
G 10.	Attitudes, Job Conditions & Standards for Skills & Knowledges Requiring School Training (p. 30).	No	No	No	Yes	More Range	No		Field, Flight Instn, Training Tech. Applications		Field Tasks
G 11.	Attitudes for Each Task and Subtask (p. 30).	Yes	No	No	No	More Range	No		Field, Flight Instn		Field Tasks
G 12.	Attitudes Requiring School Training (p. 30 & 34 implied).	No	No	No	No	Clarify	No		Field, Flight Instn		Field Tasks
H.	Task Analysis Information Sheets (TAIS)(p. 30).	Yes	No	No	No	Clarify, More Range	Specify, Need More		Field, Platform Instn, Lesson Anal./Planning, Tests & Measurements, Flight Instn, Training Tech. Applications		Field Tasks, MOI
H 1.	File Number, Course ID and Date (p. 31 implied).	No	No	No	No	Clarify	No		None		None

PRODUCTS/SUBPRODUCTS (CON REG 350-100-1 CONTENT EVALUATION FACTORS)	Does CON REG 350-100-1 Clearly Identify This Product/Subproduct as an Essential Step?	Is Sufficiently Detailed Procedural Guidance Provided?	Are Practical and Specific Working Definitions of Terms Provided?	Are Requirements Other Products/Sub-Products Impose on This Product/Sub-Product Clearly Identified?	Is the Use of Examples Satisfactory?	Are Reference Materials, Job Aids, or Other Information Sources Cited?	CON REG 350-100-1 Specifies No CDG Personnel Experience Requirements.	Experience Needed to Prepare This Product/Subproduct?	CON REG 350-100-1 Specifies No CDG Personnel Skills & Knowledges Required	Skills and Knowledges Needed.
H 2. Training Action Element For Each Task & Subtask (p. 32).	Yes	No	No	No	More Range	No		Field, Flight Instn, Platform Instn, Lesson Anal./Planning		Field Tasks, MOI
H 3. Training Condition Element For Each Task & Subtask (p. 32).	Yes	Yes	Yes	No	Yes	No		Field, Flight Instn		Field Tasks
H 4. Training Standard Element For Each Task & Subtask (p. 32).	Yes	Yes	Yes	No	Clarify, More Range	No		Field, Platform Instn, Lesson Anal./Planning, Tests & Measurements, Training Tech. Applications		Field Tasks, MOI
H 5. Training Action Element For Each Skill & Knowledge (p. 30 & 32).	Yes	No	No	No	Clarify, More Range	No		Field, Flight Instn, Lesson Anal./Planning		Field Tasks, MOI
H 6. Training Condition Element for Each Skill & Knowledge (p. 30 & 32 implied).	No	No	Yes	No	More Range	No		Field, Flight Instn, Platform Instn, Lesson Anal./Planning		Field Tasks, MOI
H 7. Training Standard Element for Each Skill & Knowledge (p. 34).	Yes	Yes	Yes	No	Clarify, More Range	No		Field, Platform Instn, Lesson Anal./Planning, Tests & Measurements, Training Tech. Applications		Field Tasks, MOI
H 8. Training Action Element for Each Attitude (p. 34 implied).	No	No	No	No	None Prov	No		Field, Lesson Anal./Planning, Flight Instn		Field Tasks, MOI
H 9. Training Condition Element for Each Attitude (p. 34 implied).	No	No	No	No	None Prov	No		Field, Flight Instn		Field Tasks
H 10. Training Standard Element for Each Attitude (p. 34 implied).	No	No	No	No	None Prov	No		Field, Flight Instn		Field Tasks
H 11. Training Criterion for Each Training Objective (p. 34).	Yes	No	No	No	More Range	No		Field, Platform Instn, Lesson Anal./Planning, Tests & Measurements, Training Tech. Applications		Field Tasks, MOI
I. Course Sequenced TAIS's (p. 35).	Yes	Yes	Yes	No	More Range	No		Field, Platform Instn, Lesson Anal./Planning, Training Tech. Applications		Field Tasks, MOI
I 1. Clustered TAIS's (p. 35).	Yes	No	No	No	More Range	No		Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Training Tech. Applications		Field Tasks, MOI

PRODUCTS/ SUBPRODUCTS	CON REG 350-100-1 CONTENT EVALUATION FACTORS	Does CON REG 350-100-1 Clearly Identify This Product/Subproduct as an Essential Step?	Is Sufficiently Detailed Procedural Guidance Provided?	Are Practical and Specific Working Definitions of Terms Provided?	Are Requirements Other Products/Sub-Products Impose on This Product/Sub-Product Clearly Identified?	Is the Use of Examples Satisfactory?	Are Reference Materials, Job Aids, or Other Information Sources Cited?	CON REG 350-100-1 Specifies No CDG Personnel Experience Requirements.	Experience Needed to Prepare This Product/Subproduct?	CON REG 350-100-1 Specifies No CDG Personnel Skills & Knowledges Required	Skills and Knowledges Needed.
I 2.	TAIS's Sequenced Within Clusters (p. 36).	Yes	No	Yes	No	More Range	No		Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Training Tech. Applications		Field Tasks, MOI
I 3.	TAIS Clusters Sequenced (p. 37).	Yes	Yes	Yes	No	More Range	No		Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Training Tech. Applications		Field Tasks, MOI
J.	Evaluation Planning Information Sheets (EPIS) (p. 43).	No	No	Yes	No	Yes	No		Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Training Tech. Applications		Field Tasks, MOI
J 1.	Training Objectives Listed Within Each Cluster (p. 43).	No	No	Yes	No	Yes	No		None		None
J 2.	List Clusters With Training Objectives That May be Examined as a Unit (p. 44).	No	No	No	No	None Prov	No		Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Training Tech. Applications		Field Tasks, MOI
J 3.	List Clusters With Training Objectives That Form Logical Groups for Separate Examination (p. 44).	No	No	No	No	None Prov	No		Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Training Tech. Applications		Field Tasks, MOI
K.	TAIS: Learning Analysis (p. 45).	Yes	No	No	No	More Range	Need More		Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Tests & Measurements, Training Tech. Applications		Field Tasks, MOI
K 1.	List Teaching Points for Each Training Objective (p. 46).	Yes	No	No	No	More Range	No		Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Training Tech. Applications		Field Tasks, MOI
K 2.	List Subordinate Teaching Points for Any Teaching Point (p. 46).	Yes	No	No	No	Clarify, More Range	No		Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Training Tech. Applications		Field Tasks, MOI

PRODUCTS/ SUBPRODUCTS	CON REG 350-100-1 CONTENT EVALUATION FACTORS: Does CON REG 350-100-1 Clearly Identify This Product/Subproduct as an Essential Step?	Is Sufficiently Detailed Procedural Guidance Provided?	Are Practical and Specific Working Definitions of Terms Provided?	Are Requirements Other Products/Sub-Products Impose on This Product/Sub-Product Clearly Identified?	Is the Use of Examples Satisfactory?	Are Reference Materials, Job Aids, or Other Information Sources Cited?	CON REG 350-100-1 Specifies No CDG Personnel Experience Requirements. Experience Needed to Prepare This Product/Subproduct?	CON REG 350-100-1 Specifies No CDG Personnel Skills & Knowledges Required. Skills and Knowledges Needed.
K 3. Sequence Teaching Points Within Training Objectives for Effective Learning (p. 46)	Yes	No	No	No	Clarify, More Range	No	Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Training Tech. Applications	Field Tasks, MOI
K 4. List References for Each Teaching Point (p. 46).	Yes	No	No	No	Yes	No	Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Training Tech. Applications	Field Tasks, MOI
K 5. Standardized List of References (p. 46).	Yes	Yes	Yes	No	Yes	No	None	None
K 6. List Method of Instruction for Each Teaching Point (p. 46).	Yes	No	No	No	More Range	No	Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Training Tech. Applications	Field Tasks, MOI
K 7. List Media and Aids for Each Teaching Point (p. 47).	Yes	No	No	No	More Range	No	Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Training Tech. Applications	Field Tasks, MOI
K 8. List Training Equipment and Facilities for Each Teaching Point (p. 48).	Yes	No	No	No	More Range	No	Field, Lesson Anal./Planning, Flight Instn, Training Tech. Applications	Field Tasks
K 9. Revise Methods of Instruction by Tradeoffs Between Best Possible and Available Media & Aids, Training Equipment & Facilities (p. 49).	Yes	No	No	No	None Prov	No	Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Training Tech. Applications	Field Tasks, MOI
K 10. List Estimated Time for Each Teaching Point (p. 49).	Yes	No	No	No	Clarify, More Range	No	Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Training Tech. Applications	Field Tasks, MOI
K 11. List Estimated Time for Each Training Objective (p. 49).	Yes	No	No	No	Clarify, More Range	No	Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Training Tech. Applications	Field Tasks, MOI
L. Lesson Plan (p. 49).	Yes	No	No	No	None Prov	Need More	Field, Platform Instn, Flight Instn, Lesson Anal./Planning, Training Tech. Applications	Field Tasks, MOI

PRODUCTS/ SUBPRODUCTS	CON REG 350-100-1 CONTENT EVALUATION FACTORS	Does CON REG 350-100-1 Clearly Identify This Product/Subproduct as an Essential Step?	Is Sufficiently Detailed Procedural Guidance Provided?	Are Practical and Specific Working Definitions of Terms Provided?	Are Requirements Other Products/Sub-Products Impose on This Product/Sub-Product Clearly Identified?	Is the Use of Examples Satisfactory?	Are Reference Materials, Job Aids, or Other Information Sources Cited?	CON REG 350-100-1 Specifies No CDG Personnel Experience Requirements.	Experience Needed to Prepare This Product/Subproduct?	CON REG 350-100-1 Specifies No CDG Personnel Skills & Knowledges Required	Skills and Knowledges Needed.
L 1.	Identify and List Each Lesson (p. 49).	Yes	No	No	No	None Prov	No		Field, Platform Instn, Flight Instn, Lesson Anal./Planning, Training Tech. Applications		Field Tasks, MOI
L 2.	Design Each Lesson (p. 49).	Yes	No	No	No	None Prov	Sufficient		Field, Platform Instn, Flight Instn, Lesson Anal./Planning, Training Tech. Applications		Field Tasks, MOI
L 3.	Continuously Revise Lessons With Results of New Technology & Training Quality Control (p. 50).	No	No	No	Yes	None Prov	Sufficient		Field, Platform Instn, Flight Instn, Lesson Anal./Planning, Training Tech. Applications		Field Tasks, MOI
M.	Training Literature (p. 50).	Yes	No	No	No	None Prov	No		Field, Platform Instn, Flight Instn, Lesson Anal./Planning, Training Tech. Applications		Field Tasks, MOI
M 1.	Select Training Literature for Lesson Content & Each Training Objective (p. 50).	No	No	No	No	None Prov	No		Field, Platform Instn, Flight Instn, Lesson Anal./Planning, Training Tech. Applications		Field Tasks, MOI
M 2.	Design Method for Teaching Student to Use Training Literature (p. 51 implied).	No	No	No	No	None Prov	No		Lesson Anal./ Planning		MOI
N.	Program of Instruction (POI)(p. 51).	Yes	No	No	No	None Prov	Sufficient		Field, Platform Instn, Flight Instn, Lesson Anal./Planning		Field Tasks, MOI
O.	Training Schedule (p. 51).	Yes	No	No	No	None Prov	No		Platform Instn, Flight Instn, Lesson Anal./ Planning, Training Tech. Applications		MOI
P.	Test Outline (p. 54).	Yes	No	Yes	No	More Range	No		Field, Lesson Anal./Planning, Tests & Measurements		Field Tasks
P 1.	Training Objectives Arranged/Combined for Testing Purposes (p. 54).	Yes	No	No	No	None Prov	No		Field, Flight Instn, Lesson Anal./Planning, Tests & Measurements		Field Tasks

PRODUCTS/ SUBPRODUCTS	CON REG 350-100-1 CONTENT EVALUATION FACTORS	Does CON REG 350-100-1 Clearly Identify This Product/Subproduct as an Essential Step?	Is Sufficiently Detailed Procedural Guidance Provided?	Are Practical and Specific Working Definitions of Terms Provided?	Are Requirements Other Products/Sub-Products Impose on This Product/Sub-Product Clearly Identified?	Is the Use of Examples Satisfactory?	Are Reference Materials, Job Aids, or Other Information Sources Cited?	CON REG 350-100-1 Specifies No CDG Personnel Experience Requirements.	Experience Needed to Prepare This Product/Subproduct?	CON REG 350-100-1 Specifies No CDG Personnel Skills & Knowledges Required	Skills and Knowledges Needed.
P 2.	List Possible Versions of Each Training Objective (p. 55).	Yes	No	No	No	More Range	No		Field, Flight Instn, Training Tech. Applications		Field Tasks
P 3.	Sampling Plan for Testing Versions of Each Training Objective (p. 56).	Yes	No	Yes	No	More Range	No		Field, Lesson Anal./Planning, Tests & Measurements, Flight Instn, Training Tech. Applications		Field Tasks
Q.	Minimum Test Standards for Each Training Objective (p. 60).	Yes	No	No	No	Clarify, More Range	No		Field, Flight Instn, Tests & Measurements, Training Tech. Applications		Field Tasks
Q 1.	Each Version of Each Training Objective Altered for Testing, If Necessary (p. 61).	No	No	No	No	More Range	No		Field, Flight Instn, Tests & Measurements, Training Tech. Applications		Field Tasks
Q 2.	Job Conditions and Standards for Each Training Objective Altered for Testing Purposes (p. 61).	Yes	No	Yes	No	More Range	No		Field, Flight Instn, Tests & Measurements, Training Tech. Applications		Field Tasks
R.	Test Instruments (p. 64).	Yes	No	No	No	More Range	No		Field, Platform Instn, Flight Instn, Lesson Anal./Planning, Tests & Measurements, Training Tech. Applications		Field Tasks, MOI
R 1.	General Test Design (p. 65).	Yes	No	No	No	Clarify, More Range	No		Field, Platform Instn, Flight Instn, Lesson Anal./Planning, Tests & Measurements, Training Tech. Applications		Field Tasks, MOI
R 2.	Design Test Problems (p. 65).	Yes	No	No	No	More Range	No		Field, Platform Instn, Flight Instn, Lesson Anal./Planning, Tests & Measurements, Training Tech. Applications		Field Tasks, MOI
R 3.	Design Answer Sheet (p. 65).	Yes	No	No	No	More Range	No		Field, Platform Instn, Flight Instn, Lesson Anal./Planning, Tests & Measurements, Training Tech. Applications		Field Tasks, MOI

PRODUCTS/SUBPRODUCTS	CON REG 350-100-1 CONTENT EVALUATION FACTORS	Does CON REG 350-100-1 Clearly Identify This Product/Subproduct as an Essential Step?	Is Sufficiently Detailed Procedural Guidance Provided?	Are Practical and Specific Working Definitions of Terms Provided?	Are Requirements Other Products/Sub-Products Impose on This Product/Sub-Product Clearly Identified?	Is the Use of Examples Satisfactory?	Are Reference Materials, Job Aids, or Other Information Sources Cited?	CON REG 350-100-1 Specifies No CDG Personnel Experience Requirements.	Experience Needed to Prepare This Product/Subproduct?	CON REG 350-100-1 Specifies No CDG Personnel Skills & Knowledges Required	Skills and Knowledges Needed.
R 4.	Test Instrument Review (p. 66).	Yes	No	No	No	More Range	No		Field, Platform Instn, Flight Instn, Lesson Anal./Planning, Tests & Measurements, Training Tech. Applications		Field Tasks, MOI
R 5.	Faculty Produced Record of Performance (p. 66).	Yes	No	No	No	More Range	No		Field, Flight Instn, Tests & Measurements, Training Tech. Applications		Field Tasks, MOI
R 6.	Test Administration (p. 67).	Yes	No	No	No	More Range	No		Field, Flight Instn, Tests & Measurements, Training Tech. Applications		Field Tasks
R 7.	Directions for Scoring (p. 68).	Yes	Yes	Yes	No	None Prov	No		Field, Flight Instn, Tests & Measurements, Training Tech. Applications		Field Tasks
R 8.	Test Validation (p. 68).	Yes	No	No	No	None Prov	No		Field, Flight Instn, Tests & Measurements, Training Tech. Applications		Field Tasks
S.	Training Quality Control (p. 70).	Yes	No	Yes	No	More Range	Need More		Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Tests & Measurements, Training Tech. Applications		Field Tasks, MOI
S 1.	Percent of Students Achieving Minimum Standards (p. 73).	Yes	No	Yes	No	Yes	No		None		None
S 2.	Analysis of Performance Errors (p. 74).	Yes	No	No	No	More Range	No		Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Tests & Measurements, Training Tech. Applications		Field Tasks, MOI
S 3.	erage Student Performance (p. 74).	Yes	Yes	Yes	No	Yes	No		None		None
S 4.	Interpreting Test Instrument Deficiencies (p. 75).	Yes	No	Yes	No	None Prov	No		Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Tests & Measurements, Training Tech. Applications		Field Tasks, MOI

CON REG 350-100-1 CONTENT EVALUATION FACTORS / PRODUCTS/ SUBPRODUCTS		Does CON REG 350-100-1 Clearly Identify This Product/Subproduct as an Essential Step?	Is Sufficiently Detailed Procedural Guidance Provided?	Are Practical and Specific Working Definitions of Terms Provided?	Are Requirements Other Products/Sub-Products Impose on This Product/Sub-Product Clearly Identified?	Is the Use of Examples Satisfactory?	Are Reference Materials, Job Aids, or Other Information Sources Cited?	CON REG 350-100-1 Specifies No CDG Personnel Experience Requirements.	Experience Needed to Prepare This Product/Subproduct?	CON REG 350-100-1 Specifies No CDG Personnel Skills & Knowledges Required	Skills and Knowledges Needed.
S 5.	Interpreting Student Performance (p. 76).	Yes	No	Yes	No	None Prov	No		Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Tests & Measurements, Training Tech. Applications		Field Tasks, MOI
S 6.	Test Results Report (p. 76)	Yes	No	No	No	None Prov	No		Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Tests and Measurements, Training Tech. Applications		Field Tasks, MOI
S 7.	Monitoring Training Quality and Adjusting Training Program (p. 77).	Yes	No	Yes	No	None Prov	No		Field, Platform Instn, Lesson Anal./Planning, Flight Instn, Tests & Measurements, Training Tech. Applications		Field Tasks, MOI

Appendix I

CONTENT OUTLINE OF A PRODUCT ORIENTED REORGANIZATION OF A PORTION OF USCONARC REGULATION 350-100-1

This appendix presents results of the fifth step taken in detailed analysis of USCONARC Regulation 350-100-1. Based on information obtained from the interviews, questionnaire, and detailed analysis of USCONARC Regulation 350-100-1, it was concluded that a major source of difficulty could be alleviated by reorganization of the Regulation's content with consideration of the eight content factors found in Appendix H.

That portion of USCONARC Regulation 350-100-1 used in the reorganization example was, "Deriving Supporting Skills and Knowledges" (Reg. pp. 29-30, par. 7), which is included in Section II - Identifying Job Conditions, Standards, and Supporting Skills, Knowledges, and Attitudes (Reg. pp. 24-30) of the Training Analysis (Reg. pp. 24-44). This example portion also is Subproduct G 7. of Product G., as found in Appendices E, F, G, and H of this report.

Two examples of the content reorganization are presented in this appendix; the first shows the outline format only, and the second presents the outline format with an explanation of each item listed.

This content reorganization format was employed as an evaluation standard while reviewing and analyzing USCONARC Regulation 350-100-1, and, in part, formed the basis for many of the suggestions regarding the Regulation that are expressed in the Results (Chapter III), Conclusions (Chapter IV), and Recommendations sections (Chapter V) of this report.

TRAINING ANALYSIS

1. Objective of training analysis

2. General procedure

3. Scope of training analysis

4. Product G. Job Task Data Cards (JTDC's)

4.a Subproduct G 1.|

4.b Subproduct G 2.|

4.c Subproduct G 3.|----------See subproduct G 7. for breakdown into required subproduct elements.

4.d Subproduct G 4.|

4.e Subproduct G 5.|

4.f Subproduct G 6.|

4.g Subproduct G 7. Skills and Knowledges for Each Task and Subtask.

4.g.1 Definition of terms

4.g.2 Experience or expertise required

4.g.3 Required inputs

4.g.4 Procedure

4.g.5 Required outputs

4.g.6 Subproduct performance standard

4.g.7 Examples

4.g.8 References

4.g.9 Review, approval or validation

4.h Subproduct G 8. |

4.i Subproduct G 9. |

4.j Subproduct G 10.|----------See subproduct G 7. for breakdown into required subproduct elements.

4.k Subproduct G 11.|

4.l Subproduct G 12.|

TRAINING ANALYSIS

1. Objective of training analysis. The objective of this section in the Regulation should clearly state not only the definition of training analysis but also reasons for the analysis and the specific use to which information from the training analysis will be made.

2. General procedure. The general procedural steps (products) required to complete the training analysis should be identified, defined, and their interrelationships explained. The dependency of each product on the other should be clearly evident.

3. Scope of training analysis. The scope should describe any boundaries or limitations on the procedures for completing and intent of the training analysis. The user should be clearly aware of exactly how the products and subproducts are to be utilized in the SEP.

4. Product G. Job Task Data Cards (JTDC's). The next step is to clearly identify the first required product of the training analysis. It should be fully and specifically defined along with statements of general procedural guidelines, any particular user expertise or skills and knowledges required, the use for which the product's information is intended, and any suggested review, validation or approval of the product.

4.a Subproduct G 1.|

4.b Subproduct G 2.|

4.c Subproduct G 3.|----------See subproduct G 7. for breakdown into required subproduct elements.

4.d Subproduct G 4.|

4.e Subproduct G 5.|

4.f Subproduct G 6.|

4.g Subproduct G 7. Skills and Knowledges for Each Task and Subtask. The first subproduct required to complete the product is here clearly identified in the text and defined.

4.g.1 Definition of terms. All terms employed that are not considered part of the user's repertoire should be listed and defined in a manner that is meaningful to the user and practical for completion of the subproduct.

4.g.2 Experience or expertise required. Identify and explain the reasons for any special experience or skills and knowledges required of the user to successfully complete the subproduct.

4.g.3 Required inputs. List each product/subproduct containing information required by the user to optimally complete this subproduct. With the listing of each product/subproduct, those items of information specifically required as inputs should be indicated.

4.g.4 Procedure. In a step-by-step manner, list the detailed procedure required to complete the subproduct. Such specific step-by-step guidance is almost essential to obtaining subproducts that are standardized across job types.

4.g.5 Required outputs. Next, each product/subproduct requiring information from this subproduct for optimal completion should be listed. The items of output information need not be indicated for they are identified along with the inputs of the other products/subproducts.

4.g.6 Subproduct performance standard. The standard of performance required of each subproduct is to meet the information requirements of products/subproducts requiring inputs from this subproduct. The outputs listed in 4.g.5 define the scope, content, and quality of information that should be provided by this subproduct which reaches performance standard if it enables satisfactory completion of the other products/subproducts.

4.g.7 Examples. Examples should be provided that clearly illustrate the completed subproduct and/or any specific procedural step. These examples should be clearly applicable to a wide range of jobs and tasks and not, for example, be limited only to tangible object related jobs or tasks.

4.g.8 References. Cite both generally and specifically relevant reference materials from the bibliography that aid completion of the subproduct or any one of its procedural steps. These citations should include reference to specific chapters, sections, pages, or paragraphs.

4.g.9 Review, approval or validation. Define, give the reasons for, and provide procedures for any suggested review, approval or validation of completed subproduct steps, the draft subproduct, or the completed subproduct.

Appendix J

USAAVNS COURSES BEING SYSTEMS ENGINEERED

The list of thirteen courses shown were those being systems engineered at USAAVNS as of October 1969. The courses are listed under the CDG responsible for their being systems engineered: Fixed Wing (F/W); Rotary Wing (R/W); Department of Maintenance Training (DOMT); and Air Traffic Control (ATC). It was the CDG personnel systems engineering these courses who were interviewed and surveyed by the HumRRO Division No. 6 (Aviation) researchers.

COURSES BEING SYSTEMS ENGINEERED

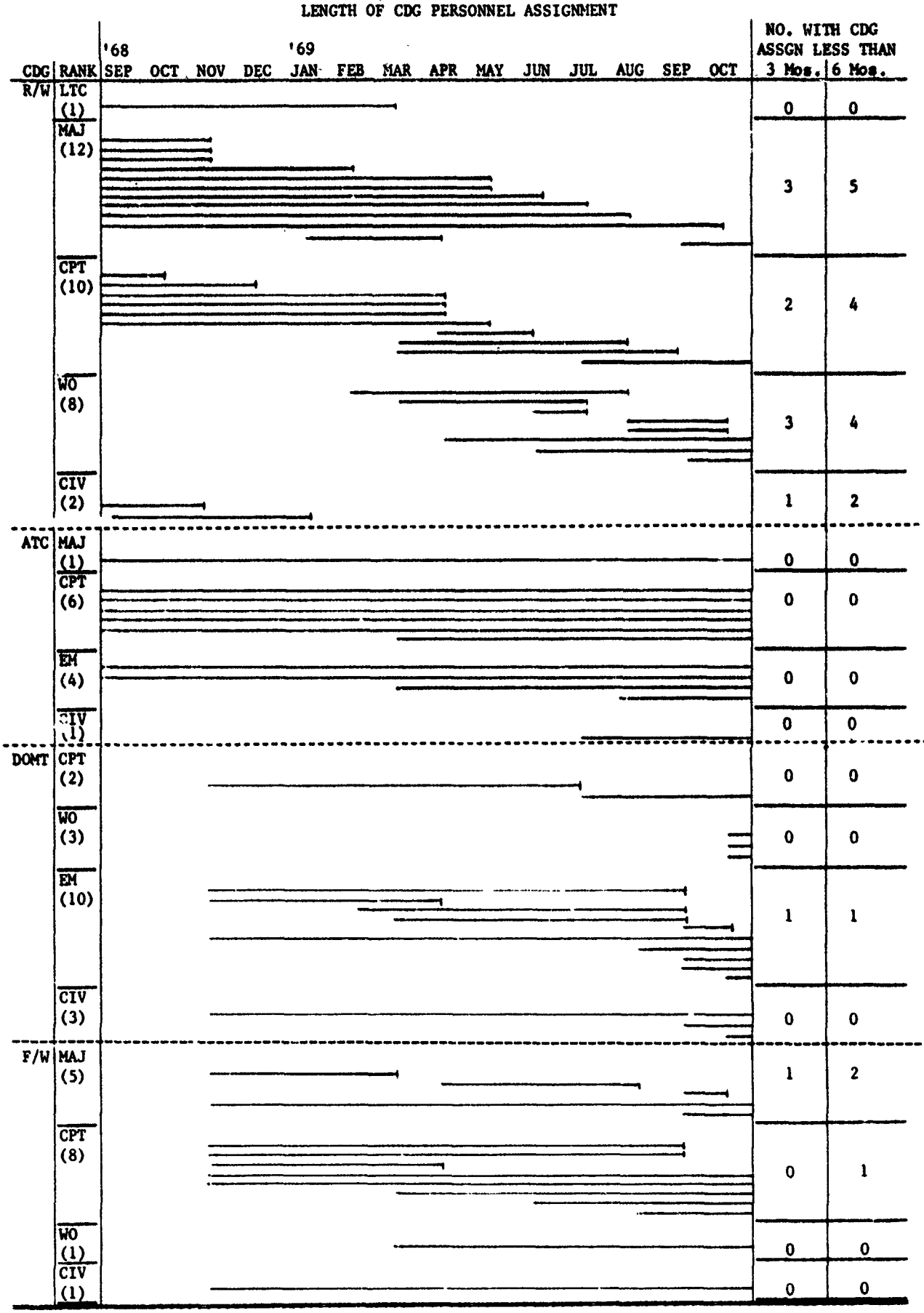
F/W	1.	Officer/WO F/W Aviator	2B-1980-A 2B-061B-B 2B-061C-B
R/W	1.	Officer/WO R/W Aviator	2C-1981-B 2C-062B-B 2C-062B-C
DOMT	1.	Helicopter Door Gunner Qualification	600-67A1F
	2.	O-1/U-6 Airplane Repair	600-67B20
	3.	OH-13/OH-23 Helicopter Repair	600-67M20
	4.	OH-58 Helicopter Repairman	600-67V2T
ATC	1.	ATC Specialist - Tower	93A10-93H20
	2.	ATC Specialist - GCA Radar	93A10-93J20
	3.	ATC Specialist - En Route	93A10-93K20

Appendix K

CDG PEPSONNEL TURNOVER

This appendix presents two summaries of personnel turnover within CDGs from September 1968 through October 1969. The first summary shows graphically the length of assignment, by rank, of personnel within each CDG. The length of the line indicates the duration of CDG assignment for each individual within each rank category. It can be seen that as the USAAVNS SEP progressed, higher ranking CDG members were terminated and replaced by lower ranking personnel, thus reducing the systems engineering expertise and experience levels of CDGs. In the Rotary Wing (R/W) CDG especially, assignments of less than six months were common. The second summary presents in tabular form an analysis of the percent of personnel turnover by rank, within each CDG. Excepting the ATC CDG, it can be seen that higher ranking officer and working level EM turnover is above 50 percent in most cases, and approaches or equals 100 percent for many personnel categories.

LENGTH OF CDG PERSONNEL ASSIGNMENT



CDG	RANK	NO. WITH CDG ASSGN LESS THAN 3 Mos.	6 Mos.
R/W	LTC (1)	0	0
	MAJ (12)	3	5
	CPT (10)	2	4
	WO (8)	3	4
	CIV (2)	1	2
ATC	MAJ (1)	0	0
	CPT (6)	0	0
	EM (4)	0	0
	CIV (1)	0	0
DOMT	CPT (2)	0	0
	WO (3)	0	0
	EM (10)	1	1
	CIV (3)	0	0
F/W	MAJ (5)	1	2
	CPT (8)	0	1
	WO (1)	0	0
	CIV (1)	0	0

ANALYSIS OF CDG PERSONNEL TURNOVER

CDG	Rank	Number of CDG Personnel*	Number of CDG Personnel Reassigned	Percent of CDG Turnover
RW	LTC	1	1	100
	MAJ	11	11	100
	CPT	10	9	90
	WO	7	5	71
	Civ	2	2	100
	Total	31	28	90
ATC	MAJ	1	0	0
	CPT	6	0	0
	EM	3	0	0
	Civ	1	0	0
	Total	11	0	0
DOMT	CPT	2	1	50
	WO	0	0	0
	EM	6	5	83
	Civ	1	0	0
	Total	9	6	67
FW	MAJ	4	3	75
	CPT	7	3	43
	WO	1	0	0
	Civ	1	0	0
	Total	13	6	46
All CDG's		64	40	62

*The number of CDG personnel assigned before August 1969

Appendix L

USAAVNS SYSTEMS ENGINEERING PROGRAM MILESTONES

The items listed in this table represent a reduction of the USAAVNS milestone chart developed locally to guide administration and implementation of USCONARC Regulation 350-100-1. This milestone chart designates responsibility for accomplishment of each SEP milestone to either the CDG, the DOI, or to the training department. This table lists each milestone on the USAAVNS chart, and, opposite it with an "X" indicates whether the training department, DOI, or the CDG was responsible for accomplishing the milestone. This table was prepared by HumRRO Division No. 6 (Aviation) researchers to summarize in convenient reference form the milestones used by USAAVNS in implementing the Regulation, and the USAAVNS SEP element responsible for its accomplishment.

USAAVNS SYSTEMS ENGINEERING PROGRAM MILESTONES

Dept	DOI	CDG	
	X		1. Request Job Identification from G-1
	X		2. Provide CDG's MOIDB Task List if available
	X		3. Develop Control Point Plan
		X	4. Prepare job inventory matrix for MOS
	X		5. Validate job inventory matrix and prepare task inventory selection sheet
		X	6. Review task inventory selection sheet
		X	7. Select task for school training
	X		8. Approval of school task list
		X	9. Prepare job task data card for each task or sub-task
	X		10. Approval of job task data cards
		X	11. Convert task and/or sub-tasks to training objectives and criteria (TAIS)
	X		12. Approval of training objectives and criteria
		X	13. Sequence training objectives
		X	14. Prepare lesson analysis (TAIS)
		X	15. Recommend location of training
	X		16. Approval of completed TAIS and location of training
		X	17. Prepare evaluation planning information sheets (EPIS)
		X	18. Cluster training objectives to form individual lessons
	X		19. Approval of training objective grouping

USAAVNS SYSTEMS ENGINEERING PROGRAM MILESTONES
(Continued)

Dept	DOI	CDG		
X			20.	Prepare lesson material
	X		21.	Coordination, concurrence and approval of lesson material
X		X	22.	Group T.O. for testing purposes and prepare test outline
	X		23.	Coordination, concurrence and approval of test outline
X			24.	Prepare and coordinate resource requirements
	X		25.	Coordinate and approve resource requirements
X			26.	Prepare related instruction and test material
	X		27.	Coordinate and approve related instruction and test material
		X	28.	Validate and revise test instruments
X			29.	Prepare draft annexes to POI

Appendix M

USAAVNS G-1 IDENTIFICATION OF THE JOB

This appendix presents an example of a job identification prepared by USAAVNS G-1 for use by a CDG. Although a substantial amount of information is provided, it should be noted that CDGs found they had to supply additional job identification information in order to complete those products/subproducts based on job identification information.

USAAVNS G-1 IDENTIFICATION OF JOB

OH-58 Helicopter Repairman - 67V2T

1. Job Structure

   a. Skill level is 67V2T. Incumbent must know scope and limitations of organizational, direct and general support maintenance.

   b. 67V2T progresses to 67V40, then to 67Z50.

2. Duty Positions

   a. OH-58 Helicopter Repairman

   b. Senior OH-58 Helicopter Repairman

   c. OH-58 Crew Chief

   d. Airfield Service Supervisor

   e. Maintenance Supervisor/Section Chief

   f. Maintenance Supervisor/Platoon Sergeant

3. Units and Organizations Assigned

   a. 67V2T graduates will be assigned to the following typical TOE organizations:

      17-108G Air Cav Trp, Inf Div Armd Cav Sqdn
      57-42G HHC, Airborne Div Brigade
      1-47G Avn Co, Separate Brigade
      1-256G HHC, Avn Bn, Avn Gp
      17-58G Air Cav Trp, Armd Cav Sqdn
      17-56E HHT, Armd Cav Sqdn
      6-302G HHC, Div Arty (Inf Div)

      NOTE: It is assumed that the OH-58 will be assigned to the same TOE units that presently are assigned OH-13/OH-23 or OH-6A's.

   b. General Mission Statement

      Incumbent performs PMD and PMP on assigned OH-58 helicopters, changes minor assemblies, adjusts systems and maintains maintenance forms and records.

c. Typical Organizations

(1) TOE 7-42G Inf Div Brigade

Avn Section

1 CPT	Sec Comd	1981
3 WO	RW Aviator	062B0
1 E-5	Sr Hel Mech	67N20
1 E-4	Petrl Stor Sp	56C20
1 E-4	Oban Hel Mech	67N20

(2) TOE 1-58E Avn Gen Support Co, Airborne Avn Bn

Utility Support Section

1 Lt	Section Ldr	1981
1 Lt	LOH Flt Ldr	1981
1 Lt	Util Flt Ldr	1981
5 WO	Hel Pilot	062B0
2 E-5	Hel Crew Chief	67N2F
2 E-5	LOH Crew Chief	67N2P

NOTE: As TOE's are revised to reflect the assignment of OH-58 Helicopters and 67V graduates become available, the LOH positions will reflect 67V20 instead of 67N20 as do current TOE's.

4. Related Units, Organizations and MOS's

a. See paragraph 3a.

b. Related MOS's.

67V20 OH-6A Helicopter Repairman
67N2[illegible] UH-1 Helicopter Repairman
67Y20 AH-1G Helicopter Repairman
67Z50 Aircraft Maintenance Supervisor

5. Major Job Requirement

Must be qualified as Aircraft Maintenance Apprentice (67A10). Must know scope and limitations of various categories of maintenance and their application to OH-58 helicopters. Must know ground checks and their application in determining operating efficiency of components of OH-58 helicopters. Must know theory and principles of operations of gas turbine engines, sections, accessories and major components. Must know inspection, trouble-shooting and replacement of components such as starter, fuel

control tachometer generator, fuel and oil pumps and deicing valve. Must know operation of engine electrical system to include rigging and adjustment of the fuel control unit after installation. Must know basic electricity, wiring diagrams and schematics. Must know how to inspect and replace helicopter instruments. Must know theory of flight and all phases of operation and maintenance of the flight control system and how to track the main and tail rotor blades. Must know procedures for repair to nonstructural, nonstressed areas of airframe. Must know purpose and use of special tools and test equipment applicable to the OH-58 helicopter. Must know how to disassemble OH-58 helicopters for storage or transit. Must know how to compute helicopter weight and balance. Must be able to interpret technical publications and be able to maintain helicopter maintenance forms and records. Must know procedures for operational testing of armament specialist in daily preflight checks, preventive maintenance, field stripping, cleaning, loading and unloading. Must know safety procedures for installed armament systems.

6. Work Environment.

Special demands will be placed upon the incumbent when working in the open, in tents, sheds or other field expedients for shelter. Incumbent will be expected to perform satisfactorily under weather conditions ranging from extremely hot to extremely cold. With limited shelter and protection from the elements, the incumbent must adequately perform under snowing, raining, windy, muddy or blowing sand conditions. Long hours, minimum sleep, and possible enemy harassment of the work site will place additional demands on the incumbent.

7. Supervision

Minimum supervision will be available at small, forward or isolated detachments. Minimum supervision will be available during repair/recovery of downed aircraft from forward tactical areas.

8. Equipment

a. Special tools for OH-58.

Tool set, general mechanic
Tool set, organization maint. A, B, C
Refueling devices
Generators of varying KW
APU
Special tools in truck, van ship 2½

b. All tools and equipment are standard.

9. Information Sources

AR 611-201 w/changes 1-8
TOE listed at 3a
Common Subjects and Reference Data for Army Aviation in the Field Army - Jan 68
Interviews with two officers from DOI, Fort Rucker, Alabama

Appendix N

USAAVNS SEP TASK SELECTION CRITERIA FOR SELECTING OR REJECTING TASKS FOR SCHOOL TRAINING

The twelve criteria shown are those developed by USAAVNS SEP personnel in an effort to extend those criteria listed in USCONARC Regulation 350-100-1 in a manner to render them more practically and specifically applicable to USAAVNS courses. After the selection decision had been made, USAAVNS CDGs coded each task on the task inventory to one or more of the selection criteria, thus creating a record of each task's disposition regarding school training.

TASK SELECTION CRITERIA FOR SELECTING OR REJECTING TASKS FOR SCHOOL TRAINING

Prerequisite

1. Basic civilian experience
2. Basic military training (016B-Basic Tng, 1980 Branch Q)

Initial School Training

3. Task is critical for mission accomplishment
4. Task is essential in performance of other task
5. Task is required immediately on job entry
6. Task is required for career development
7. Task is specialized and cannot be taught on the job

Advanced School Training

8. Task is not required for entry into MOS

OJT

9. Task can be easily learned on the job
10. Task is similar to other tasks
11. Task is performed by small percentage of MOS entry
12. Task is required for Aviation Management

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Army aviation

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report reviews a pioneering effort to use modern training technology in designing and implementing training courses for a large-scale system. Information on the systems engineering of Army Aviation training and on the CONARC regulation it was designed to comply with is provided. Conclusions and recommendations for improving the effectiveness of the systems engineering of training are presented.

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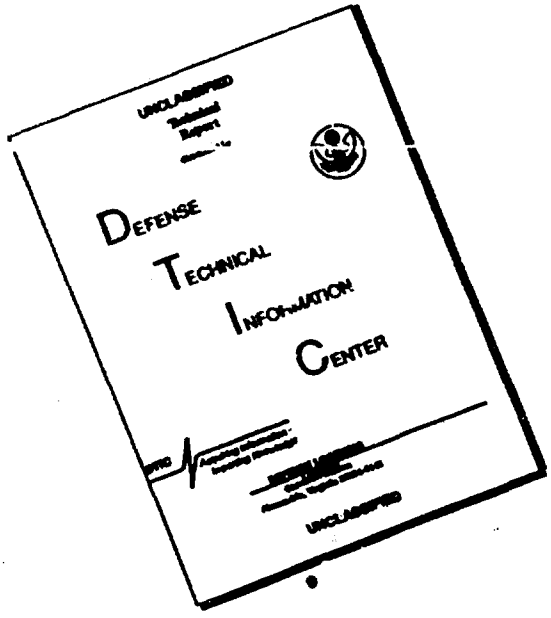

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